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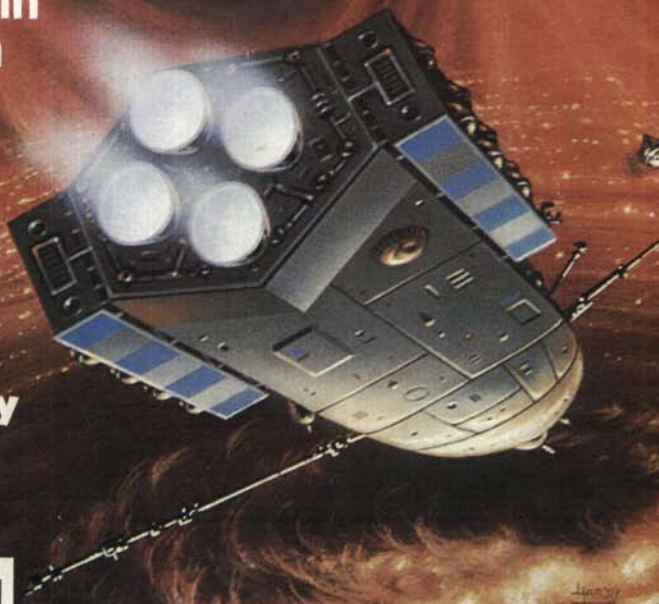

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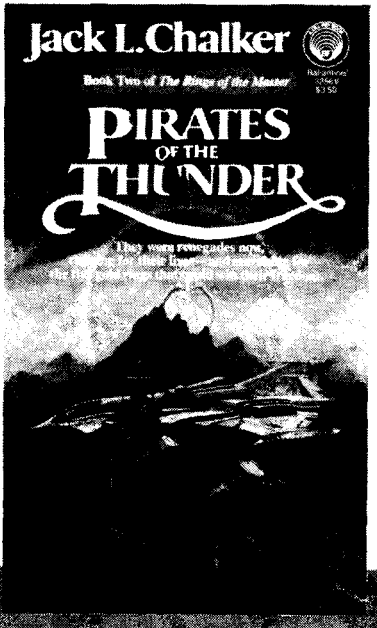

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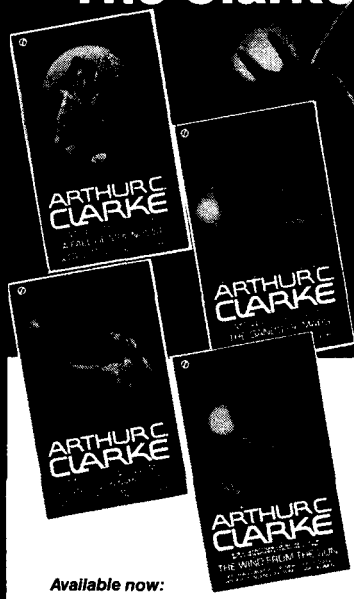

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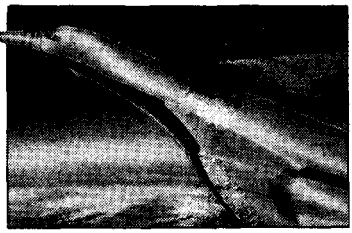

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Guest Editorial

AN ALIEN VIEWPOINT

C.S. Bushnik

I suppose before I do anything else, I'd better introduce myself. I'm an ordinary, average corn snake *(Elaphe guttata guttata*, 4' 5", 2.5 lbs.), and a permanent guest in the home of your editor. Recently he was complaining that too few science fiction writers manage to come up with stories that present truly *alien* (by which he means "nonhuman") viewpoints. I remarked that the problem can hardly be lack of imagination, because no one needs to look very far afield for living examples of such viewpoints, even right here on Earth. "Mine, for instance," said I; and he, ever ready to let somebody else do his work for him, said, "You're on!"

So that's what I'm doing in the editorial slot this month. In fairness to Stan, I must admit that this didn't get him *completely* off the hook. Actually *writing* an editorial requires the use of a typewriter or word processor, or at least a pen, and all of those require rather delicate coordination of the fingers. Since I don't *have* any fingers (much less coordination thereof), he had to put this on paper. Fortunately he does take dictation tolerably well (and taking dictation from somebody who can't talk is no small accomplishment).

Anyway, I offer myself as one example of the many alien viewpoints you're surrounded by every day. Why mine? Simply because it's the one I know best. Of course, from my point of view I'm the norm and you folks are the "aliens," but I'm flexible enough to try to see it your way. (Actually, false modesty aside, *any* snake is flexible enough to do *lots* of things humans can't do.)

How you or I or anyone else sees the world depends first of all on how we're built and what sort of equipment we

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have. (If you *must* make bad jokes about how I seldom see the world except through the walls of a glass cage, please get them out of your system now, and then pay attention. This is serious!) Humans and snakes breathe the same kind of air (though you breathe a lot more than your fair share of it), and we like roughly the same range of temperatures (though you're less particular about them, which I admit is one point for your side). We both see by "visible light," though I gather you're better than I am at judging distances and seeing details of distant objects. Sometimes I envy you that, just a bit, though frankly it seems to me that you're more concerned with distant objects than you need to be. After all, the things that really matter are the ones close enough that they can attack you or you can eat them; and if I may say so, you seem a bit slipshod in that department. You don't even have a Jacobson's organ, and I hardly ever see your tongue outside your mouth.

You do waggle your tongues a great deal *inside* your mouth, of course. When I asked Stan about that, he said that was to make "sounds" that you use for communication. Then he had to explain acoustics, and why you folks are so obsessed with "communication." Personally, I get along fine without it (except when somebody asks me to write a guest editorial), and my family (well known down South Carolina way) has been doing so a lot longer than your type has even existed. As for sound, I'm not *totally* insensitive to it (as many books have insensitively claimed), though I'll admit I miss quite a bit. I detect ground vibrations more effectively than pressure waves in air, and my frequency response is a lot more limited than yours—but I'm not sure I really regret that. When Stan plays his baritone horn, it makes such a gosh-awful racket I'm just as glad I can't hear the other things he plays.

If I *were* going to get heavily into communication, my language would be a lot different from yours. Yours is full of idioms like "give me a hand," "a leg up," and "stand on your own two feet." To all of these I reply: not applicable. If I needed the concepts at all (which is not likely), I'd find quite different ways to express them. You're so dependent on all those extra body parts you find it hard to get through a paragraph without referring to them; I wouldn't know what to do with them. But then, unlike a Boy Scout, I don't *need* hands (or even a rope) to practice knots.

All these physical differences inevitably help shape our philosophies, attitudes, and ways of life. Probably the most important such difference is the fact that you're homeothermic and we're poikilothermic. (You commonly say "warm blooded" and "cold-blooded," but I prefer to avoid those terms because of the unfortunate connotations they've picked up in some circles.) That leads to a lot of the most obvious differences in lifestyle. You can stay active under a wider range of temperatures than I can, but the price is that you *have* to stay a lot more active than I would care to. To a typical snake, a typical human

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seems to be constantly dashing hither and yon in a way so frenetic it borders on madness—mostly, it seems, for the purpose of gathering food, which you consume in prodigious quantities. The crowning irony is that you also spend a lot of time, energy, and money trying to teach each other to relax—something any snake does naturally, without instruction, and far better than even the most diligent and practiced human.

I mentioned money in there—a concept so bizarre that I hope I never have to explain it to another snake, and I'm glad I don't need to explain it to you. I barely understand it myself, but it seems to epitomize just how oddly you folks live. As I understand it, most of you don't even catch your own food (and many of you even look down on the few who do). Instead you depend on others to do it for you, and persuade them to give you some by doing other things for them, and money is how you keep track of whether you've done enough *for* other people to deserve what you want *from* them. Most of the things you do in this bewildering labyrinth of

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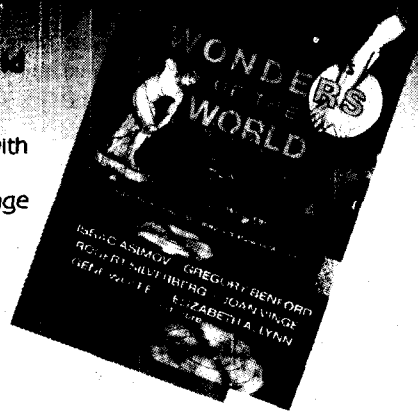

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exchanges seem pretty silly and pointless to me, I must admit, but then I'm only a snake. Anyway, Stan assures me that getting food is the essential point of it all. That I can understand, though your way of going about it seems awfully convoluted.

And once you get food—the things you do with it! (I won't even comment on the enormous variety of utterly unappetizing *things* you eat.) I was amazed (nay, *astounded*) to learn that many humans consider it gross and disgusting that we eat live mice and swallow them whole, even if they're bigger than our own heads. Actually, we don't eat them live; we kill them first, as quickly and mercifully as we know how (which is more than you can say for a cat), and our jaws are *built* to stretch for large morsels (even as your hands are built to hold calculators or beer mugs). Furthermore, we don't do it very often. I only eat when I'm hungry, and sometimes that doesn't happen for a month or two at a stretch. So there you have it: we eat only what we need, which is very little; we let it live undisturbed until the moment we need it; and we eat it very neatly, with no bloodshed, no waste, and minimal fuss or muss. Humans, on the other hand (catch that? I speak your language!), eat several times *every day!* They kill their food long before they need it—sometimes even *months* before!—and usually in some fairly messy fashion. Often they don't kill it at all, but hire somebody else to do it for them, and then act as if they had nothing to do with it. And they always hack their food into little pieces, waste quite a bit by throwing it away, and fuss over the rest with fire and metal tools and all kinds of ritual before they actually get down to eating it. And you say *our* eating habits are gross and disgusting?

But I don't wish to give offense. After all, you can't help it; you're only human. I'm just trying to illustrate how different we are, despite being close neighbors, and how your habits look as strange to me as mine do to you. I could go on at considerable length, but space is limited. I suppose I'm expected to say something about reproduction, since many humans seem to have that on their minds almost constantly. I'll just remark that we don't understand such incessant preoccupation—or, on a related subject, why you keep in such close touch with your relatives. I've never met a snake who knew or cared who his parents or children were—or had any reason to. But I'm told that human parents watch with intense interest and pride every step of their offspring's growth and development, and even continue to follow their progress long after they go off on their own (which, I might add, takes an incredibly long time). For us, independence begins at birth and growth lasts all our lives—and while it has its advantages, it's also a bit of a nuisance. Our skins don't grow with the rest of us, so every few weeks we grow a new one under the old and, when it's ready, peel the old one off like a glove (though without, of course, benefit of hands). It gets a bit uncomfortable before a shedding, and a few days before it happens we secrete a fluid between the old and new skins to help them separate. That makes us temporarily blind, since our eyes are covered by transparent

(continued on page 186)

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New Data on L. RON HUBBARD'S

WRITERS OF THE FUTURE CONTEST

by Algis Budrys

Good news. L. Ron Hubbard's Writers of The Future Contest has been extended to the end of 1987, and even if you don't win a prize there are fresh features that could do you a lot of good.

First, there are meaningful no-strings cash prizes, and fringe benefits including recognition, encouragement, and a publication offer to the winners and some runners-up. Added have been faster reporting times, professional writing hints on your stories that *nearly* made it, and a series of invitational tuition-free special workshops for winners and some finalists, taught by expert speculative-fiction writers. So if you're an aspiring author of fantasy or science fiction, with no more than three short stories or one novelette professionally published, here's all you do: Enter the contest.

Every three-month quarter, beginning January 1, there's a round of judging for original manuscripts up to 17,000 words. A panel of top judges then selects three winners of $1000, $750 and $500. Third and Second Place also receive framed, very handsome certificates. First place receives a trophy guaranteed to dominate almost any mantelpiece. . . . And while the checks are mailed to the winners quickly, the certificates and trophies are conferred at our annual Awards ceremony, to which our new writers are invited, expenses paid.

Then, from among the four quarterly First Place winners, a special panel of judges selects the winner of the L. Ron Hubbard Gold Award to The Author Of The Writers of The Future Story of The Year. The announcement is made at the Awards, and results in an even more elegant trophy, plus an additional $4000.

Want some? There's no entry fee, and submitting your manuscript conveys no publication rights. (We do ask you to enclose a stamped, self-addressed return envelope.)

What wins is any kind of good science fiction or fantasy, in the opinion of our top judges, who include Gregory Benford, Anne McCaffrey, Larry Niven, Jerry Pournelle, Robert Silverberg, Jack Williamson, Gene Wolfe and Roger Zelazny.

Then there are the anthologies — *L. Ron Hubbard Presents WRITERS OF THE FUTURE Vols. I, II,* and, as of early 1987, *III*. I edit them for Bridge Publications, and we offer payments of up to $1000, in addition to the Contest prizes. The anthologies — which have impressed a lot of people, including other editors and publishers — publish the winners, and some runners-up. (They also include how-to-write essays by some of our judges.)

Summing up: If your story makes it into the semi-finals, you'll get it back with a helpfully intended critique from me. If it gets into the Finals, you may get a prize, you may at least get a publication offer, and if you're in the anthology, you're automatically invited to our next workshop, where we teach idea generation, idea improvement, and career management, along with other professional skills.

Good enough? Then you can write in for complete entry rules, or you can just go ahead and submit a manuscript, to:

Writers of the Future Contest
P.O. Box 1630
Los Angeles, CA 90078

A rational approach would be to borrow or buy the anthologies and study them. (The first two have an obsolete Contest address in them, but the mail will be forwarded.) They're $3.95 paperbacks, and you might as well see what you've been missing.

Meet you at the Awards?

— Algis Budrys

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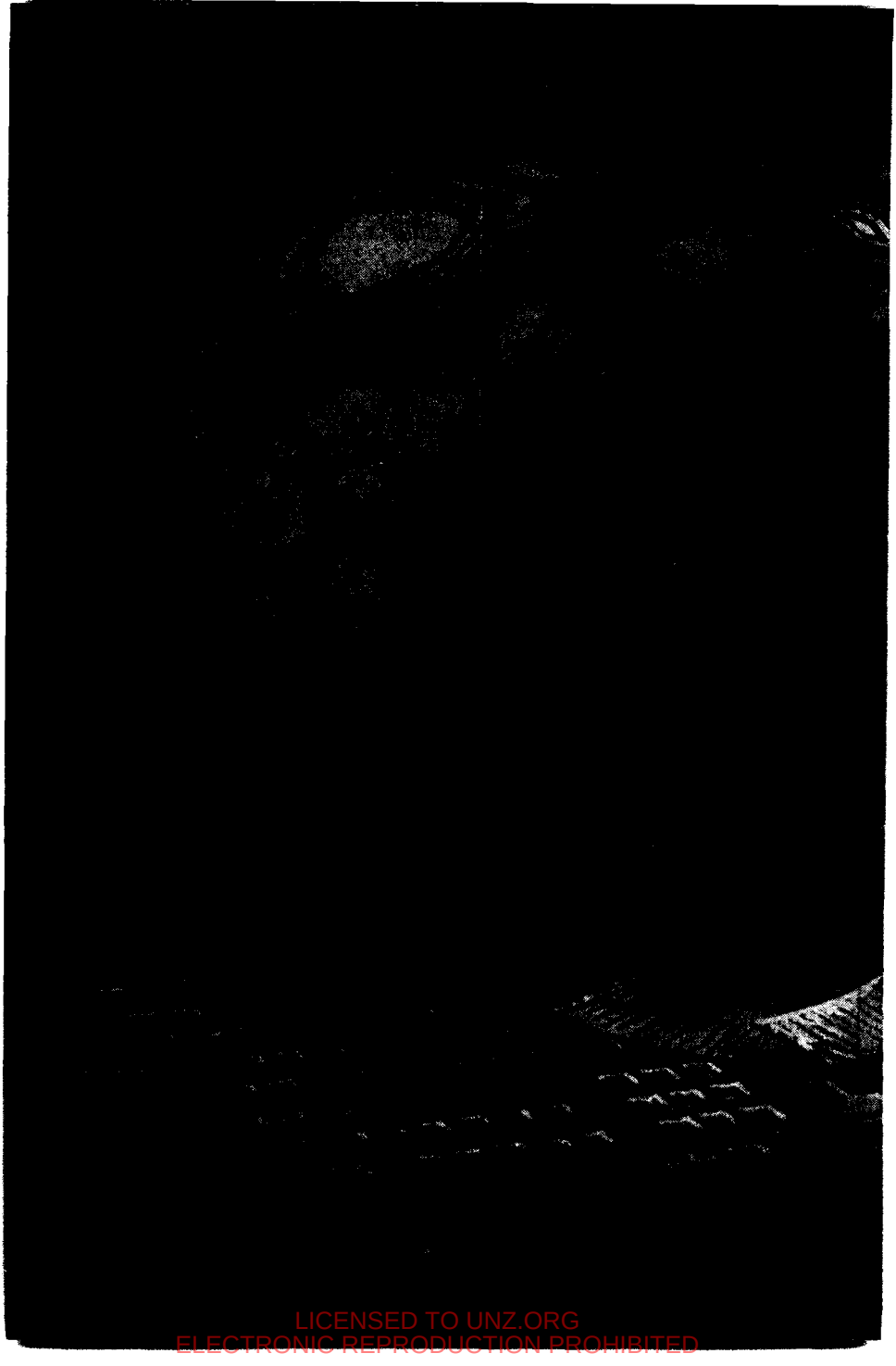

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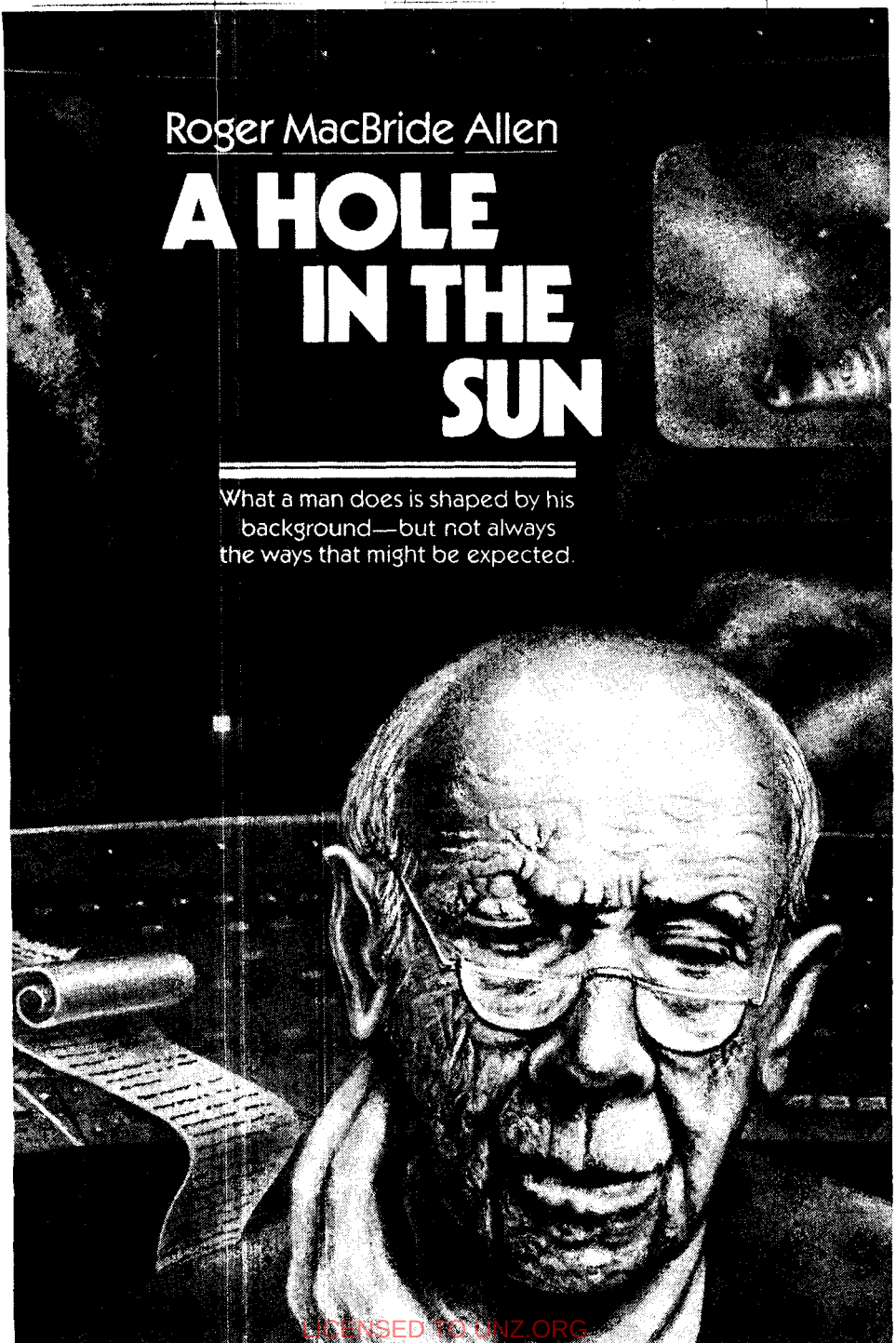
Roger MacBride Allen

A HOLE IN THE SUN

What a man does is shaped by his background—but not always the ways that might be expected.



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Below me, the Sun broods, a surly monarch, ever uneasy on his throne. A bare 15 million kilometers from the surface of a star, I sit and stare down at the roiling, endless fires of fusion. Here in this thick-shielded wordlet, it is impossible to escape the Sun's face: in every compartment, there is always at least one monitor set to show his blazing image. We circled him, safer in fact than we feel in spirit, endlessly fascinated by the huge, fearsome marvel-land below. The Solar Polar Observatory, this bubble of light and air so close to the fires, has been my home for years now, and I believe now it will be my last home. There might be better places to live than in the Sun's grasp, but I am certain there are no better places to die. Jason taught me that.

Most people know that the Observatory was a long time aborning, know that it was a crackpot idea everyone ignored for decades before anyone took it seriously. Hardly anyone recalls that the first one to propose it was one Dr. Joseph Ellis—that is to say, myself. I promoted the idea as best I could for years, but try as I hard as I could to sell the idea of a permanent, manned facility in a close-in polar orbit of the sun, try as I might to convince people that the technology to make it work was in hand, no one of consequence would listen or believe. Still, I never really gave up on it, and I grew old along with my wild idea.

Then, one day, decades after I first put forward the idea of the Observatory, a young man of means named Jason Alcott came across the design for the Observatory, and turned it into his own dream. Very quickly, very quietly, he corralled money, talent and moral support together to make it real. He worked hard to get together all the needful material and talents. And he decided he needed me.

I was long since retired from full time work when his letter came, offering me the directorship of the Solar Polar Observatory. The offer was a bolt from the blue, a complete shock, as fantastic as if I had been offered the presidency of Oz. I had never ceased campaigning for the Observatory, but deep in my heart of hearts, I think I had long since concluded no one would ever actually build it. Fighting for it was a way to keep busy, keep alive. In this day and age, it is boredom and inactivity that kills the old, and I did not wish to go that way. Now, suddenly, my therapeutic fantasy was real. At first, I wanted to take a day or two and consider the offer—but I realized there was nothing *to* consider. My wife was long dead, and she and I had been childless. There were a few comforts of home that might be precious to an old man, but none could compensate for a retirement that I had struggled against for so long already.

It was all too easy to imagine this Alcott fellow buying old Joe Ellis off, giving him a desk and a title while some sharp young character actually ran the place. Easy to see myself as a harmless figurehead, handed a safe, meaningless sinecure because giving me that was better PR than freezing the "inventor" of the Observatory out.

But even a job as figurehead would be better than sitting in a too-empty house, listening to my arteries harden.

Full of doubt, I wrote back that same

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day and accepted the job, and wondered about this young upstart who had seized my idea and made it his own. I knew who Jason *was*, of course. It was impossible not to know of the wealthy families that owned the powersats and how they spent their money in their elegant and exciting lives in the grand orbiting cities—impossible not to know that the Alcotts were the richest of them all, impossible not to know that Jason was the irrepressible youngest son of that family.

Long before I met him, I had plenty of reasons for resenting Jason Alcott. He was young and rich, I was old and living on a barely adequate pension. He had stolen my dream and turned it, I imagined, into his plaything—and I feared that the only way to get myself onto what was suddenly *his* Observatory was to tolerate the antics of the idle rich. I *wanted* to resent him. I tried. For the longest time, we didn't meet: I avoided him as best I could, and found reasons to stay and manage things from Earth while the Observatory habitat took shape out in space.

Jason meantime remained in High New York, circling Earth in a distant orbit. We managed to do business just the same, making calls and sending letters. Gradually, as we corresponded, I discovered something—even through the filters of his hastily scribbled notes on the margins of very official documents, through hurried phone calls, through the cheerful blather of the society pages, even with a king-sized chip on my shoulder, it was impossible to dislike Jason. His intelligence, his kindness, his pugnacious sense of humor, shone through all the barriers.

And, equally surprising, he was competent—or at least he had the skill to hire the competent. That was evident in the revised design of the Observatory. Jason's crew of professional spatial architects, well-heeled and yet careful with a dollar, produced a facility of functional beauty and economy.

But by far the most astonishing feature of that splendid design was that it represented a forthcoming reality, not a dream. Propelled by money and enthusiasm, everything began happening quickly. The shell of the great Observatory station grew quickly in Earth orbit. Navigation planners perfected the plans to launch it toward close-in Solar orbit. The massive shielding, the huge sunshade, the instrument clusters, the probe launchers—the habitat shell rapidly turned into a functioning station. Thanks to the remarkable speed of modern robotic construction techniques, and the sophistication of the spacers' artificers, the Solar Polar Obseratory grew to completion in months, not years.

Finally, inevitably, the time came for me to pack up my baggage and travel to the Observatory that had magically sprouted out of the vacuum. It had been twenty years since I have ventured off Earth, and it was with an old man's misgivings that I suffered myself to be lofted into orbit, and endured the complex journey of orbit transfers, dockings and long waits aboard this space station or that. At length, I arrived at the Observatory, and spent the last leg of the trip, in endless fascination and trepidation, staring at it out the port, a massive structure growing larger as we came closer. The pilot docked his tug, and I went aboard, to be welcomed only by

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an airlock technician who was banging something with a wrench. If I wasn't quite ready for the adventure, neither was the Observatory.

I slowly settled into the strange new setting, and began to wonder if I truly had the nerve to live in this place, once it was orbiting a bare 15 million kilometers from the Sun.

Soon after my own arrival, I myself was called upon to welcome Jason Alcott aboard the Observatory—the lab, the worldlet, the toy his money had paid for.

I had seen dozens of photos of Jason, flats and 3-D, but I had never trusted the impressions offered by a photo (a strange attitude in a scientist who relied on the images that cameras and telescopes could bring him). Even less did I trust the polished images, the sanitized words and personalities of the great and wealthy trotted out by skilled publicity agents.

But when he came through the airlock and I took his hand for the first time, Jason was—*Jason*, the Jason of the ribbon-cuttings and the affable speeches and the witty scribbles in the margins.

A smiling, sprightly, almost nervous eyes, a rounded face and mischievous smile. A sprinkling of freckles; soft, almost pudgy fingers that somehow formed into a vise-like grip when he shook hands. A moment of musical laughter in sheer joy of meeting you; a short, stocky body almost going to fat, yet somehow suggesting a wiry strength —a suggestion confirmed when he slapped you on the back and knocked the wind out of you. Simple clothes suited more to the place than to his station in life. That was Jason, or at least the first of Jason. He was just what the press releases would have you think. Either his PR people were wise enough to leave his splendid personality alone in their releases, or else his spirit had succesfully escaped whatever traps they had laid for it. He was himself.

"Professor Ellis!" he said as if meeting me was the happiest moment in his life. "At long last, the man who thought of all this!"

As he pumped my hand, I felt as if I was in the presence of a cheerfully irresistible force: I liked him at once. "I *dreamed* of it, sir," I said. "But it took you to think it might be real. Welcome to what you built."

"Thank you," he said with happy sincerity. "I hope you are a relentless tour guide. This is my first time aboard, and I want to see *everything!*"

The last of the optical, radio, x-ray and other telescopes were just being installed as I led Jason on our rounds, showing off the living quarters, the observation centers, the computer center, the "storm cellar" that afforded the staff additional shielding against the worst the Sun might do, the docking ports, the reference library (with books, *real* books one could hold and handle, aside from the disks and data blocks that carried information but not the musty traditions of the scholar), all the devices and comforts and necessities that would make this spinning cyllinder and its adjoining zero-spin instrument section a working place of science.

I had expected Jason to take a complacent proprietor's polite interest in the Observatory, but he immediately proved me wrong. He seemed to know his way about already, as if he had memorized

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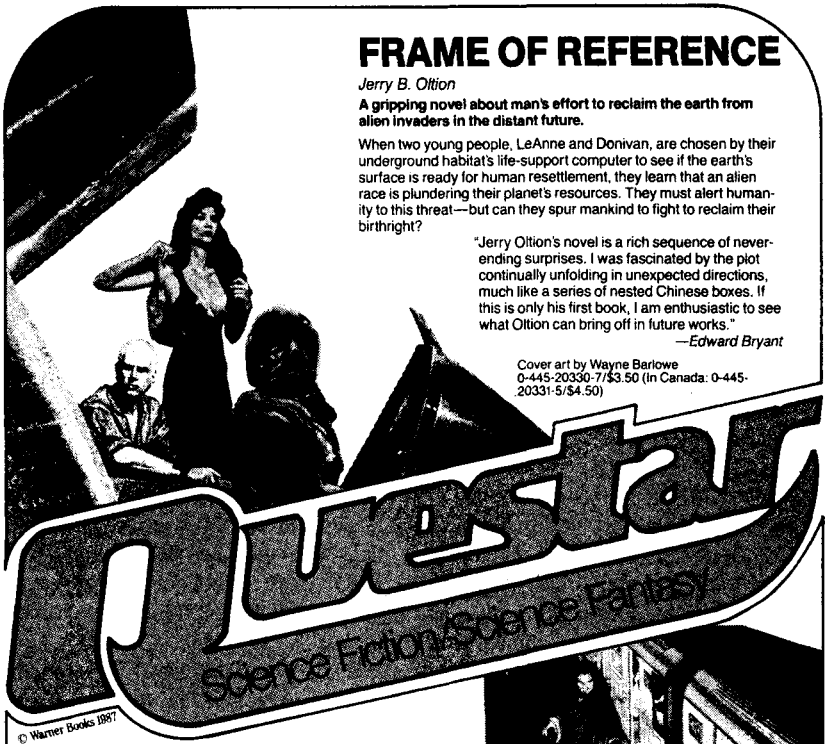

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the plans. He asked endless questions, intelligent questions, recalled the names of the technicians and scientists that had been recruited, led me into sections and compartments even I didn't know existed, happily got his clothes covered in dust and smudges from inspecting everything from the propulsion system to the plumbing. Finally, with the greatest reluctance, he allowed me to drag him into my office.

The designer of the station had to be a mind reader, for the director's office was ideally suited to my ideas of what such a room should be. Understated, handsome, serene, well-carpeted floors, tastefully decorated walls, shelves and furnishings of sleek blond wood. That same unknown designer had also included wonderfully comfortable chairs and a well-stocked bar. Jason and I put both to good use after that tour.

It was a sore temptation to relax and chat aimlessly with Jason about the Observatory and all the grand plans, but there was something else that needed to be cleared up first.

We got settled with our drinks and then I dropped the small talk. "Mr. Alcott," I said, putting down my drink. "There's something that's concerned me for a while, and I can't think of any delicate way of asking it, so I'll be blunt: How long am I staying on?"

Jason looked baffled, confused. "Professor Ellis? I'm not sure I understand."

"Mr. Alcott. I am a well-preserved 79 years old. I've got many more good years in me, but few people believe an old man who says *that,* no matter how sharp the geriatrics people get. You came in on this project, and in eleven months you have accomplished more than I did in twenty years. 'Your' people vastly outnumber 'mine' on the board of trustees, and I might add that their checkbooks are quite impressive too. I realize that you hold no official position, but I also understand who is running that board behind the scenes. Right now this Observatory doesn't need a permanent director; it needs a straw boss to get the place built, and that's what I'm doing. Once we launch toward close Solar orbit, the job of director will change so much that a new director could come in and start running the place without any real disruption, since all the routines and operations will change tremendously anyway. I don't want to put in three months and discover I've been an interim director two weeks before we launch. I could go on, but you get the point: There are many reasons to let me go, and I can think of none for keeping me on."

Jason was silent for a long moment. "I notice you made no mention of your qualifications," he said carefully.

"I'm not a fool; I know that scientific or administrative competence are often secondary in such decisions."

"They are not in this case," Jason replied firmly. "You had a idea, and you stuck with it for years, when logically the whole thing was hopeless. You're a stubborn, talented man who didn't happen to have deep enough pockets. But this Observatory exists in large part thanks to you. It was your idea, and I must insist that we acknowledge your part in it. I may have paid for it, but it is in a real sense yours. I have no intention of easing you out."

"Will your people on the board see

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it that way?" I asked. It would be the easiest thing in the world for an "independent" board majority to fire me, for Jason to shrug and calmly say it was out of his hands.

"They will do what I say, and *I* say you stay. Trust me, I learned how to railroad a committee before I could write a check—and check writing is a skill my family learns early." He grinned at his little joke, but there was something false, almost bitter, around the edges of his humor. It was instantly obvious there was something about his family that didn't sit easy with him.

He leaned forward and looked me straight in the eye. "I want you to stay," Jason said. "Will you, Doctor Ellis?"

There was such earnestness, such sincerity in that voice, that I couldn't disbelieve him. "I will stay. And I thank you for your confidence. But call me Joe."

"If you'll call me Jason."

"A bargain, sir." I reached across the desk and shook his hand.

His face lit up with pleasure, and he pulled a sheaf of papers out of his pocket. "Good, that's settled. We have planning to do, a great deal of it. Staffing. Orbits. Constructions. *Real* work." So there was no small talk. Immediately, that afternoon, that moment, we got down to the job at hand.

But he never did call me Joe. It was always "Joseph." Had his researchers done their work so thoroughly that he knew I preferred the full name, that I found the overly informal monosyllable distasteful, that I tolerated its use, hoping that "just plain Joe Ellis" would get grants "Dr. Joseph Ellis" would not. Or did he sense all that in me, sense that I was a *Joseph*, not a Joe? It didn't matter. Whether it was thanks to hired snoops or great empathy, he came up with the right answer. He always did.

I have never met anyone else who understood people as well—or anyone else that people so thoroughly failed to understand.

The basic construction and equipage of the Observatory were complete, but there were a thousand problems—great issues and minor details—to take care of, and we needed every bit of help we could get. Provisioning the great station with everything from fresh fruit to photographic chemicals, chasing the inevitable bugs out of the computer system, finalizing the design of the Sundrops, the heavily shielded instrument packages which the Observatory was to launch directly into the Sun, meeting with the parade of important visitors, soothing the tempers of Earthside scientists who needed their experiments run at once, riding herd on simulations and dry-run tests of the pointing systems and sensing equipment—endless problems to occupy my mind.

At first Jason was merely a frequent and welcome visitor to the Observatory, who always seemed to turn up at exactly the right moment to solve the problem. But somewhere along the line Jason installed himself full-time, moved aboard as a more-or-less unofficial resident manager of the station. He always solved the political issues, the supply problems, the scheduling mix-ups.

But why would *he* want to live on the Observatory. It was a strange decision, but I was too thrilled by the chance to work—and overwhelmed by the volume

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of work—to stop and think about abstract mysteries.

But I *should* have wondered. Even if Jason had taken on the Observatory, surely he was meant for other things. Born and raised in the High New York Space Habitat, a native long ago inured to the magic spires twisted to compensate for the Coriolis effect, the "starscrapers," upsidedown towers that extruded through the base of the great revolving cylinder, their "penthouses" in the lowest levels, furthest from the habitat's core.

The 'scrapers, in their slender majesty, resembled the skyline of Old New York, far below, but from the living room picture windows of High New York's towers, one looked not out across a mere cityscape, but directly out onto space itself, the stars and Moon and Earth and Sun wheeling about outside for one's private hubris. Jason Alcott was *meant* to be raised there, meant to have a hand in running that sky city, meant to settle down to a life of corporate maneuvering, building some solid business accomplishment on the foundation of money and power his ancestors had gathered.

But Jason chose the Observatory instead, even decided to live in a scientific outpost rather than in the light and joy of high society.

At first I was concerned that Jason would feel left out, that he would find himself bored, disinterested, trapped inside our increasingly isolated wordlet. I need not have worried. Perhaps because he had little else to do, perhaps because he was bitten by the bug of curiosity, he decided to train himself as a technician. He hung about the labs, read technical manuals, learned his way about the hardware, studied the controlling software.

At first he was resented by the scientific staff, who were annoyed by the rich kid who had bought this place out of pocket change and came in to play scientist. They came as close as they dared to snubbing outright this dilettante who felt the right to put on a lab coat and pester them with questions.

They soon changed their minds. Within a space of weeks, he had already vastly improved the observation techniques for three of the major helioseismological instruments. As we got closer to the date for launch into our transfer orbit, he was making his own test-run observations —and coming up with amazing data.

One of the dirty little secrets of science is that some of the best work has been done by people with no officially recognized qualifications, no degrees or diplomas or titles. Pasteur was not a doctor of medicine, neither Louis nor Richard Leakey had much formal paleontological training. So with Jason Alcott. But he did more than make a contribution to science. He invented a whole *new* and invaluable science: heliosonics. He found the voice of the Sun.

He began with the tiny and specialized discipline of helioseismology. Most people associate seismic events with earthquakes, and wonder how the Sun, a glowing ball of gas, could possibly have anything to do with seismology. What they forget is that the Earth is perhaps 99 percent fluid: molten, liquid rock and metal, all of it sheathed in the thin, fragile crust of the surface, the ground we walk on. It is the Earth's

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essentially *fluid* nature that lets us study the internal structure of the planet by studying the shock waves of earthquakes and volcanic activity.

So too with the Sun. Using Earth-based instruments, scientists have long been able to measure wave activity directly on the surface of the photosphere of the sun. Horizontal wave movement can be tracked by direct observation, and vertical wave motions can be measured by tracing the doppler-shifts in the light of the images collected. (As a patch of surface riding a wave falls in toward the center of the Sun, it recedes fast enough to lengthen the apparent wavelengths of the light coming from it: in red-shifts. As it rises out away from the center, toward the Earth-based observer, it moves towards us fast enough to blue-shift.) By measuring the direction and strength of the wave motions, we can judge what shaped them—what sort of matter they must have passed through, how and when they must have been deflected, in effect allowing us to "see" deep into the structure of the Sun itself.

Jacon quickly learned the basics of helioseismology from the reference library while we were still in Earth orbit. He talked to the seismologists aboard, and fiddled with the equipment and instrumentation.

And then he came into my office bright-eyed and excited.

"Joseph," he said, "I want your permission to add an additional instrument to the Sundrops. It won't delay us much, since the probes aren't ready yet anyway." The Sundrops, the instrument packages designed to be dropped into the Sun, were already late coming from the factory. It was hoped they could last as long as five minutes before falling too deep into the photosphere and vaporizing, but the builders had trouble reaching that spec in simulations. The probes had gotten their unofficial name from a lemon candy that was popular in High New York at the time.

"What sort of instrument are you interested in?" I looked at Jason, and I liked what I saw. He looked brighter, happier, more relaxed than I had ever seen him. It was as if he no longer had to *pretend* to be happy—he *was* happy.

Jason grinned. "A microphone. Sensitive over a broad range of frequencies. I've checked, and it should be a fairly straightforward job to include them in the 'Drops."

"A *microphone?* What in heaven's name for?"

"To hear the *sounds*, Joseph. The seismo people go on and on about examining the wave forms, with all sorts of wildly elaborate visual equipment they need to check the doppler effects. But waves moving through a gaseous fluid—that's *sound!* And we can drop cheap, simple mikes down there and record the sounds—the wave forms—directly and precisely, from right on the spot, through a whole cross section of the upper layers, instead of doing it the hard way from fifteen million kilometers away and only seeing the surface wave forms."

Jason said more, but he had me hooked already. It took some convincing to get the seismo team to agree, but they became the most enthusiastic backers once the idea was explained to them.

In the end, the only ones who grumbled were the contract workers who had

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to rip open the completed Sundrops to plug in the new components. Fortunately, even that was a minor problem.

And Jason quickly found himself accepted by the Observatory staff. That was obviously important to him. But there was something that Jason wanted more: Jason wanted, even needed, to escape. That much I could see. From what, for what reasons, I couldn't say. He rarely talked about himself. But there was an air about him of a man looking back over his shoulder, a sense of urgency. He was working like a demon to get the Observatory ready, and by example got everyone else working overtime as well. He got us to beat every schedule, determined to reach the soonest possible launch date. Nothing would satisfy him but to see Solar Polar shaping orbit for the Sun, putting 150 million kilometers between Jason and whatever it was he wanted to get away from.

It was as the last checks were being run, when we had at long last set a launch date, one we could rely on, that the personification of what Jason was running from came through the airlock.

Working late in my office one evening, I got an urgent call from Jason, asking me to meet him in the commissary right away. I hurried down and found Jason there, seated at a table set for three. It was well after the dinner hour, and the rest of the big room was empty. Jason seemed tense, nervous, edgy. "He's just come aboard to see me, Joseph. He's on his way here now. He'll be difficult anyway, but if there's a stranger present, he should be more civil, a bit easier to control. I need you here."

"*Who's* on his way—" I began, but then the door opened. I looked behind me, saw the newcomer, and knew who he had to be.

The face, the voice, the body, were so much like Jason, and yet in some way I could not precisely define, so startling different.

He strode across the room toward me with the same broad, loping, confident gait as his brother, and offered me his hand. "Doctor Ellis. I am most glad to meet you," he said, flashing a perfunctory smile. "I'm Cadmus Alcott, Jason's brother."

"Good evening, Mr. Alcott. Welcome aboard." What was *he* doing here? Much confused, I glanced toward Jason, then looked at Cadmus as intently as I could without being out-and-out rude. Cadmus had that same stocky, beefy body, a bit heavier, a bit more dissipated, a bit grayer and older. He smiled as easily as his brother, but it seemed automatic, artificial, social window dressing. He was dressed immaculately, in the latest, finest style, every hair in place, his fingernails manicured to a hard, sharp perfection.

Jason remained seated at the table, his face lit by the flickering glow of a tabletop candle. His expression was grim, hard, set, angry, and his eyes gleamed in the candle flame. He did not stand when his brother approached the table. It was the only rude thing I had ever seen him do.

"Hello, Cad," Jason said. "Welcome to Solar Polar. I've ordered dinner. The serving system will have it here in about five minutes. Take a glass of wine in the meantime." He glanced at me, nodded.

I sat down uncertainly. The tension

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between these two was something palpable. Jason was suddenly angry, dangerously angry.

Cadmus took his seat smoothly and pulled his napkin into his lap. "You're coming back, Jase," he said calmly, matter-of-factly. He poured himself a glass of wine, sipped it, nodded in approval of the vintage.

"No." Jason stared at his brother in ruthlessly controlled anger. "And you won't be able to force me back. I've protected myself well. But, you will have assumed that, and *I* assume you've come prepared. You've got some weapon prepared. So what you have had better be pretty damn good."

"Suppose I just called upon the claims of family loyalty?" Cadmus asked evenly.

"The family has loyally cut my legs out from under me every time I've set foot off the path they've approved for me," Jason said. "I owe them nothing."

"Jason," Cadmus said, "that's just not so. The time has come to pay the piper for all your fun." He spoke with a bored self-assurance, as if Cadmus knew that he would inevitably win the argument, and all the talking was just empty ritual leading up to his victory. "This latest of your little projects has taken up far too much of your time already. This Observatory of yours can shape its Solar Polar orbit without further help from you, and the Observatory Foundation has nothing for me but high words of praise for what you've done. And the knowledge this facility will gather will be invaluable, I suppose. It seems as if all knowledge is, for all that it costs a great deal of money. But it's time for *you* to move on. You must take on your responsibilities within the family business. Your talents are needed."

"My business talents are good, but not tremendous," Jason said. "You could come up with a hundred people who could do the job better. What you need is my last name, one more loyal Alcott board-member for all the interlocked companies, an Alcott to take up a vote and deny it to the Krylenkos or the Simeons or the Cunningham-Chungs."

"I will disagree with your assessment of *why* you are needed," Cadmus said, almost primly. "But that doesn't matter. The point is you *are* needed. Now. Not two months from now or next week. Proxies are ready to step aside and let you take your place. But the moment is crucial."

"Crucial for this current little bit of infighting, yes," Jason said. "To realign the power structure yet again and put a meaningless million or two more in every good Alcott's pocket. But I *have* all the millions I need, and so have we all. And there will always be a crisis, a merger, an investment, a deal that "needs" my attention. *I* don't need the *deals*. No, Cad. I'm out."

With every passing moment, the two brothers looked, sounded, acted more and more alike around that dimly lit table. I looked first to Jason, then to his brother. I could trace in Cadmus every personal attribute, every physical trait, every tiny quirk and mannerism that Jason had. But Cadmus had taken the same raw material and built himself into a wholly different person. The easy social grace that Jason had fashioned into a winning natural charm, in Cadmus

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was glibness and smoothness. The assertive stubborness that for Jason served as feisty, cheerful determination, Cadmus used as simple carnivorous aggression. Jason's self-assurance was in the background, calm, relaxed. Cadmus's self-assurance reached out and grabbed you by the throat.

"Nonsense. It's in your own best interest to be concerned," Cadmus replied. "You might be the least rich member of the family—and God knows why you have always taken a perverse pride in that fact—but your portfolio *still* totes up to a considerable sum."

Jason grinned, almost laughed out loud. "Yes, it does, doesn't it? I imagine you've examined it pretty closely."

Cadmus looked up sharply at his brother. "Just what are you getting at?"

Jason's expression became serious once again, but there was a twinkle in his eyes. "Nothing. Nothing at all. But tell me, how are you going to pull me back?"

"Three phone calls from me right now and in ten minutes your friends are outnumbered on the board of trustees. Your people on the board know that. They like their jobs. You are here in no official capacity. To the best of my information, you have no title, no designated job, draw no salary, have no contractual responsibilities or duties. Am I mistaken, Doctor Ellis?" he asked, still staring at his brother.

"I'm afraid you are correct," I said.

"Therefore, Jason, quite legally, I could have you hauled off this facility as a trespasser and a stowaway. You have no legal right to be here. All the layers of paper and ownership and trusteeship between you and "your" Observatory make that so. Doctor Ellis,

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I'm sorry to say this, but I have a perfectly competent candidate for your job ready to be appointed by a re-constituted board. He could be aboard in four hours, swearing out a legal complaint against Jason. However, I hold no brief against your presence here, Doctor Ellis. If *you* would swear out the papers . . . ''

''Absolutely not,'' I said angrily.

''Of course not. Even though the refusal is a pointless gesture with no practical result besides you losing the job you've always dreamed of.'' There was a wearied acceptance of my foolish behavior in his tone of voice. Dinner arrived, a splendid coq-au-vin delivered by a service robot, and Cadmus took the plates and handed them round. ''In that case, my dear Doctor Ellis, you are out of a job.''

''Not quite yet. For the moment, I am the director of this facility,'' I said stuffily. ''I can nip your nasty plan in the bud simply by *giving* Jason a job here.''

''Oh, yes,'' Cadmus said casually. ''You are empowered to hire and fire here—''

''Subject, of course, to the approval of the board of trustees Cadmus is currently threatening to dismember,'' Jason said evenly. ''No, Joseph. You can't outsmart dear brother Cadmus *that* way. And I won't insult you by making noises about how you might as well stay on. I know you better than that.''

''Which is undoubtedly *why* he picked you for this job,'' Cadmus said. ''He was looking ahead to this moment, and your refusal now buys him some time to maneuver.''

For the first time Jason raised his voice. ''Damn you, Cadmus! Joseph, I apologize for my brother. And as for you, Cad, didn't it occur to you that if you couldn't intimidate Doctor Ellis, neither could I? He almost refused this job. Hiring a person of principle is a two-edged sword.''

''Which is precisely why I avoid hiring such people.''

''And I wish you joy of the employees you do hire.''

Cadmus snorted and started to eat. Jason followed his example, and, after a moment, so did I. No one spoke for a long time. Then, something occurred to Jason. ''I'd forgotten you wouldn't know,'' he said to me. ''There's a tradition in our family that business is not discussed during dinner.'' He returned to his food without further comment.

There was an obvious corollary that explained the silence. These two brothers had nothing but business left *to* discuss.

The food was delicious, but it was the most unpleasant meal I have ever had.

We got through the main course, then dessert, the coffee, in the same deadly silence, Cadmus serving each of us from the robot cart which moved silently back and forth between the kitchens and the table.

Finally, as if at an unseen signal, the two brothers rose as one. I got to my own feet and led them to my office, for want of a better place to take them.

I sat down behind the wide desk, once empty, now covered with work orders, status reports, personnel files. There was still work to do before we shaped orbit, lots of it. Cadmus could find plenty of ways to stop us—legal tricks,

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needed parts that never arrived. It didn't take much imagination.

Jason must have known that as well as I did, but he seemed unconcerned. He had gotten over his anger by dinner's end, and now he was himself again, at ease in the left hand visitor's chair. Cadmus chose not to sit in the other chair, and nervously paced the office.

"I need your answer, Jason," he said. "Get off this bucket and your precious scientists can go poke at the Sun. But *you* can't go. And if you refuse me, I—the family—can shut this place down, and *no* one gets to go."

"I refuse you," Jason said quietly, calmly.

Cadmus shook his head, pulled a cigar from his inside jacket pocket, carefully lit it, and puffed on it for a minute or two before he answered. "What, Jason? What have you got cooked up? What's the price? What's the deal? What will it cost? It won't be enough, but what will you try?"

Jason smiled and shook his head. "It's simply outside you, Cad. You're honestly, truly, incapable of understanding that I don't care about the money, or the power. Let me ask my own rhetorical question: What is it about the idea of my being free that *frightens* you all so much? Why do you all feel such an overwhelming urge to blot out my freedom, and cage me up, make me safely just like all the rest of you?

"I don't know the answer myself, Cadmus. But my being free of it all *does* threaten you. Maybe you don't like what you turned out to be, and I'm what keeps you from saying *you* had no choice. You don't like seeing that you could have

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gone down another road than the one the family laid out for both of us.

"Still, none of that matters. What does matter is that I know what you love—and that is the trap I laid for you. Why don't you check with your office, see if there are any important messages for you?"

Cadmus glared at his brother for a moment, dropped the cigar in an ashtray, and pulled his phone out of his pocket. There was the briefest of delays as the phone patched itself into the Observatory's comm system and beamed the call through the data link to High New York. "This is Cadmus Alcott. I'm told I should check—" He paused to listen for a long moment. "My God. Yes, I can 'contact' him. The fool is sitting in front of me, smiling." Cadmus shut off the phone and shoved it back in his pocket. "You bastard," he said, glaring at his brother.

"Then I take it you agree."

"How could I dare refuse?"

"The same way I did. Simply decide enough is enough, settle back and enjoy what you have, try something besides business. But I know you won't do that. I know you *can't*. But I expect Doctor Ellis is a little baffled by all this." He turned to me. "You'll have heard Cadmus mention that he had snooped around, looked into my portfolio. What he didn't say was how much he dreamed of getting hold of some certain bits and pieces of it. It would all match up so well with his own holdings." He turned to his brother. "I'll bet he never dreamed of getting his hands on *all* of it. I'd done my best to match my holdings to yours, Cad, hold the tiny one or two percent of this or that stock that would make your massive forty-nine percents invincible. What I have is nothing compared to the value of your portfolio—but add mine to yours, and you'll double your own net value. I *knew* that the family would try to drag me back—and I knew they'd send *you*, make you come in such a way that you'd think it was your own idea."

Cadmus retrieved his cigar and stood glaring at his brother. "Well, you baited your trap damn well. I'd be crazier than you to turn down this deal."

Jason went on. "Here's my offer. My people have drawn up all the papers needed to transfer ownership of all my financial assets to you, and I've already signed them all. I'll sell you every share of stock and every bond and asset I've got, for fifty cents on the dollar, with the clear understanding that you shield me, to the utmost of your ability, from whatever else the family might try."

Cadmus thought hard for a moment. "Make it twenty on the dollar."

"Split the difference. "Thirty-five," Jason said.

Cadmus shrugged, nodded and offered his hand. Jason took it and they shook. "Done," Cadmus said. "And don't worry. I'll hold off the others, until you're safely away. None of them are going to chase you to the Sun. I'll stick to my side of the deal."

"I know that, Cadmus. You could always be trusted once the deal was struck."

"The only way you can stay in business. Though I still think you're mad. Do you realize how much you've lost?"

"Do you have any idea what I've won? My *freedom*, Cadmus, freedom bought at the cost of throwing away

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some scraps of paper and some obscene amount of money, so much I could never spend it in my lifetime. Freedom would be cheap at a much higher price. There is much more to life, than the endless whirl of buy and sell, gain and expand. You could even come with us, take a break from the struggle, see what it's like to have time and quiet."

Cadmus looked about him, sneered openly at what he saw, and laughed. "No, Jase, I'll stay locked in the comfortable prison of the good life and the work *I* love. That's the real difference between us, you know. I *enjoy* the wheeling and dealing. I *am* free in what *I* do, because I do it by choice. How much life will you see when you're practically roasting inside the Sun aboard this tin can?"

"Because trying to lock me into what I hated is part of what you love, and I'm tired of living that way," Jason said quietly.

Cadmus simply grunted. Jason and I walked him back to the airlock in silence, and watched through a port as his launch thrusted away.

After it was out of sight, Jason turned to me, looking far too tired. "Come on, Joseph, I need a drink." He led me to the commissary bar. The automatics were shut off at that late/early hour. He went behind the bar and poured each of us three stiff fingers of Kentucky bourbon. We sat in the gloom of that half-lit room, and I listened to Jason.

"I've won the battle, not the war," he said. "Obviously, I've got to make some other moves to protect myself against the family. Cadmus will uphold his end of the bargain, but I might need other shields than that."

"We've got to do something to paper over my position here," he went on. "After all, Cadmus isn't the only one who could think of getting me kicked off, and if our board people need to have me in an official capacity—We're getting our space service tug delivered soon. I laid down the specs for her myself. Named her the *Argo*, and she'll be one trim little runner." He hesitated, grinned almost shyly. "Let's put me down as a pilot. We haven't hired one yet, and I've got the proper certificates, everything from a ore-jumper right up to conning a mobile habitat. I could fly the orbital run and con the tug."

"Pilot? Why Jason, I had no idea that you . . . "

"No one else does, either, Joseph. No one ever has." A brief, bitter, wintry smile flickered across his tired face and was gone. "Not even my fellow spacers." He raised his glass in mock salute. "Yet another curse of being rich and powerful. If your family doesn't lock you in, the world locks you out."

"I think I understand."

"With all due respect, I doubt if you can. I don't think anyone can appreciate the fetters I'm in unless he or she had worn them." Jason shifted in his seat and took a deep pull of his drink. Meeting with his brother had been hard on him.

"After all, with my wealth and position and talent, all things are possible to me, right? It's a natural assumption. Most people think it childish of me, pointless rebellion, the way I whine and snivel about my wealth. I can *have* whatever I want, and they think that's the same as *doing* what I want. They find it hard to sympathize with my prob-

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lems, and they'd all trade places with me in a minute.

"But take you for example, Joseph. When you received your college diploma, did you have to wonder if you really had done as well as everyone said, or if they had let you score high in hopes of your father paying to build a new gym?—And later, Dad *did* buy a gym. Did you ever lie awake nights wondering if you were born into this life for the sole purpose of shielding a portion of your family's wealth in a trust fund? Did you drive every good woman away from you, because you could never conquer the nagging fear that she was only after your money? Did you ever lay awake at night, and catalog your friends, sort out the drones, sycophants, leeches—and then realize you *had* no friends besides such?

"My family has never understood the difference between wanting a thing done and actually *doing* the thing for yourself. They send proxies, they hire a consultant, they pay someone else to get their hands dirty. Their time is too valuable to be taken up with work. They even hired out surrogate mothers to handle Mother's pregnancies.

"Every time I've tried to reach out and do a thing *myself*, I've been prevented by my family's smothering embrace. Up until now, I've only escaped once, when I took my pilot's training and went out to fly spacecrafts—and that was a disaster. I trained, I studied, I worked harder than I ever have in my life, and I came out a highly skilled pilot.

"But everyone in the spacelanes assumed that I had *bought* my pilot's license. I was the spoiled little dilettante rich boy who was out treating their career, their skills and arts, as a lark, an amusement. The other pilots shunned me. I couldn't get flight contracts. No one would put lives or cargo—or a ship—in the hands of a pilot they didn't trust. At the end, I hung around Deimos Station for five months before giving up and coming back to High New York—as a passenger, with the ship's crew laughing at me behind their backs. They thought I had gotten bored with the game of playing pilot, but what really happened was that I never got the chance to work."

Jason raised his glass and threw back the last of his drink in one swallow. "And that is my story. That is why I'm here. With this project, I might actually be allowed to *do* something." He sat in silence for a long moment. "Good night, Joseph." He set the glass down on the bar carefully, and walked steadily down the corridor toward his room.

I sat there in the darkness, nursing my drink, for many long hours. Jason had intended to be our pilot all along, that was clear. He was not the sort of man who did anything without careful planning. But how carefully had *he trained?*

If I made him pilot, I was betting a chance to salve his pride against the lives of everyone aboard. Could we trust Jason, gamble that he had *really* earned that chit?

Short weeks later, Jason laid in our course, and set the Solar Polar Observatory in on the groove that would lead us precisely through our dive into Hell. We launched with his hands on the controls. Some things are worth the risk.

* * *

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The Sun has been observed from the Earth for millennia, by Earth-bound telescopes for centuries, by space-borne instruments for decades. Yet, except for one or two relatively short-lived unmanned probes, all of this observation has been more or less from the plane of Earth's orbit—in other words, from points directly over the Sun's equator. But for those few early probes which could not come close or stay long, nothing has ever been seen of the Sun's polar regions. Furthermore, the resolution of even the best Earth-based work was simply not good enough. We needed observations, visual, ultraviolet, infrared, radio, gamma and x-ray, resolving down to meters and centimeters, not kilometers.

Our instruments would look at all the complex layers of the Sun in greater resolution than had ever been possible before. As we closed in on the Sun, our instruments were hard at work. The million-degree hot near-vacuum of the storm-whipped corona shone bright in ultraviolet, the outline of the ten-thousand-degree chromosphere revealed itself to our disk-blocking cameras, merging down into the photosphere, the visible "surface" of the Sun, a mere 4500 degrees at the topside temperature-minimum zone, gradually rising to about three times that value before it merged into the deep convection zones, the radiation zones, and the core. The Sun grew in the viewports, showing more detail, more violence, more wonders. The feathery jets of spicules jetted up everywhere on the surface. Sunspots, moving in formation, gaped open to reveal lower layers of the photosphere, plages flashed into incandescence, imitating the far mightier flares. Huge prominences leaped hundreds of thousands of kilometers out from the photosphere to dance in the corona. The Sun became to me less an object and more a place, a stage where mighty dramas were played out.

The Observatory was headed toward a polar orbit 15 million kilometers above the solar "surface," the photosphere. Our orbit was close enough that it would actually be inside the Sun by some definitions. According to some, the solar corona could technically be said to extend past 15 million kilometers, though at such altitudes, the corona was thinner than a good lab-grade vacuum. The Observatory would go about the Sun in a classic "ball-of-twine" path: As the Sun rotated on his axis below our orbit, every part of his surface would be visible to us on a regular, predictable schedule.

Needless to say, our early studies concentrated mostly on the poorly-understood polar regions. The too-brief glimpses of these regions that the old unmanned probes had given us were tantalizing, had provided some answers, but like all good answers in science they had raised more questions than they had settled. The probes had sent back images of weird features about the poles, engendering some lively debates indeed. But the whole sphere of the Sun, the surface and the secrets hidden deep within, were of interest to us. As we moved through the inner Solar System, all the instruments were busy, gathering preliminary data and studying the regions of space we were moving through. The scientific staff grew more and more excited as we fell deeper into the Sun's grasp.

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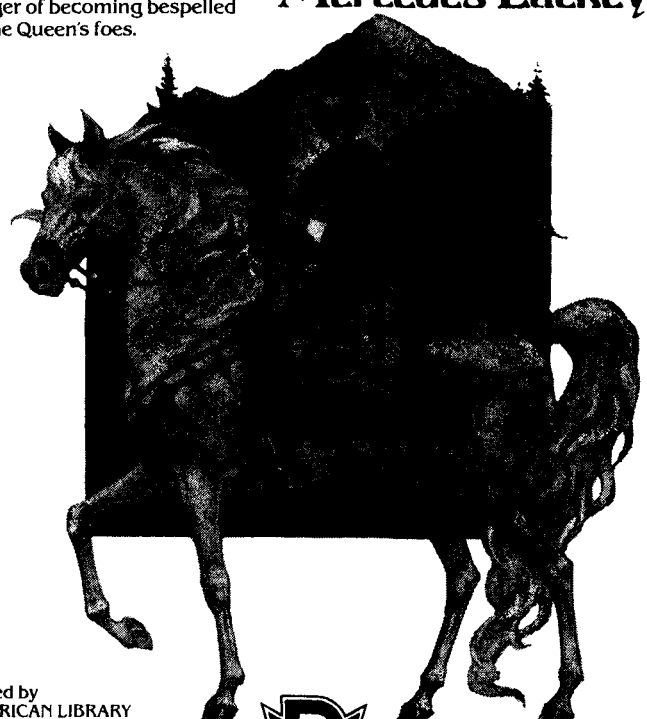

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Every day, every hour, the disk of the Sun swelled larger and larger. The friendly, life-giving spot of kindly fire seen from the skies of Earth, the shining globe that our ancestors worshipped, Old Sol that we took so utterly for granted as a tamed and trustworthy source of light, heat, and power; that same Sun grew into a mighty, capricious and terrifying star no sane person would trust in.

Ironically (but wisely), the Observatory had no ports, no windows. But every monitor screen, every computer terminal and intercom viewer aboard showed some image of the raging tyrant star that deigns to let Earth flourish. From every side, in images wrought from every wavelength of the spectrum, we watched that monster roar. The Sun was at the peak of nearly every periodic cycle ever charted, and the drama playing out across his surface was mesmerizing.

Prominences leapt out, as if to snatch at us, flares exploded and whipped the chromosphere into incandescent froth, monstrous sunspots that could swallow the Earth whole blossomed, grew, spread to ride the twisting variable rotation of the surface like leprous plagues agonizing the roiling, boiling surface.

Soon it was time for Jason's real work: It was time for the Observatory to make its final insertion burn, bringing it into close circular orbit of Old Sol.

The Observatory's engines could put out a bare one tenth *g*, but they could maintain that thrust for hours, or days, or even weeks if need be. This close to the heat and fire of the Sun, the ship had very little cooling-system margin, and of course the engines threw a lot of heat. Jason expected (and found) some slight deviation from a pure ballistic course caused by hitting slightly thicker patches of the lab quality "vacuum" of the corona. There was a narrow needle of time, velocity, altitude, thrust, aerodynamics and heat management that the Observatory had to go through.

There was one other danger: It also seemed likely that there were uncharted radiation belts or layers of charged particles at particular altitudes, constantly replenished by the inferno below. The particle physics team was watching to make sure the Observatory didn't accidentally park itself in the thick of such a maelstrom. Jason had to run plots constantly, not only for his planned orbit, but for high and low "bail out" orbits if the particle or radiation counts got too high. Jason stayed in the pilot's compartment for three days straight. McPhee, a physicist with some pilot's training, sat in as co-pilot.

I watched repeaters of Jason's controls and instruments, and knew as I watched that we not only had a pilot, but a genius, a virtuoso. Finally, quietly, perfectly, the Solar Polar Observatory shut down its engines and coasted on in orbit over the ravening hell that is the Father of Life.

We had arrived. The Observatory was to stay right where it was, permanently, its staff rotated and its perishables replenished by supply ships launched from Earth orbit. We immediately began to find mysteries, controversies, data that contradicted the accepted theories.

But the greatest hopes of discovery were pinned on the Sundrops. The Observatory carried a thousand of the

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probes, and plans called for regular drops into the photosphere. The Sundrops could either be launched off a hundred-*g* linear accelerator that ran the length of the Observatory, or else could be carried in by the service tug *Argo* if the line-ac broke down.

Soon after we arrived, the first Sundrop launched from the linear accelerator, with its heat and pressure sensors, its plasma-chemistry experiments—and its microphones. Jason and I—along with practically every other person aboard—were present in the control room when *Sundrop I* made its run, the first time in history a man-made object would touch a star. The semi-darkened room was alive with the hum of voices, the gleam and flicker of display panels, the close atmosphere of too many people in a small room.

And we heard the sound. The other instruments did their work and transmitted their data, but I was unaware of the pressure-versus-depth graphs and the physical composition readouts, did not hear the mechanical chuckle of fingers over keyboards as technicians tempted knowledge out of the raw data. All that was forgotten as I listened to the sound of Sol's voice.

We see the Sun and think we know him, or at least begin to know him, because we measure his size, his temperature, his cycles and patterns. But I listened to his voice and I realized we humans knew nothing, understood nothing. We little humans never dreamed that the Sun rang like a bell, roared like a mad lion, screamed like a tortured child, shouted with the noise of a thousand thunderclaps, sang with the gay laughter of a bluebird, played upon himself like a master violinist upon the perfect instrument. Each sound came through clear and perfect as Jason manipulated the controls, listening to one band of sound at a time. All of it was recorded, of course, to be examined and measured at leisure, and I have listened to the voice, live and recorded, many times. Always it has reached my soul, but nothing has ever been like that first time, the first moment that living things had heard the voice of a star.

The newly-christened heliosonicists, who drew their ranks from the Observatory's seismologists, audiophiles, computer hackers, physicists and solar modellers, swarmed over the tapes of Sol's voice, seeking the mechanisms that created those remarkable sounds. Where in the Sun had they originated? How far had the sound waves traveled? At what velocities? Through what density zones, through what acoustic chambering, twisted and turned by what seethings and shiftings of the convection zones, the core, the subsurface?

Jason revelled in it. Here, at last, was a thing of true value that *he* had made, that would not exist but for him. They began to map the voice, linking certain sounds with precise points and events in the solar interior.

But other work was proceeding. We made one of our most exciting discoveries the week we arrived. We discovered the Polar Depressions. The north and south poles of the Sun were *dimpled*, concave. Instead of being a smooth oblate spheroid, the fluid Sun had somehow acquired and retained wide, shallow craters, thousands of kilometers wide, centered on the poles. No one thought for a moment that they were

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either the result of impacts or volcanic activity, of course. The latter was impossible, and the former could not possibly leave a trace in the gaseous surface of the Sun. Clearly, the twin axial depressions had to be related to some sort of rotation phenomena, but no one could quite see how. But then, no one could claim to understand the Sun's rotation to begin with. It had long been known that the surface of the solar equator rotated in 33 days, while the surface at the poles completed a rotation in about 25 days. It had also been known that the speed of rotation seemed to decrease the deeper one looked inside the Sun—except that, near the core, rotation rates started to increase again.

It was our work aboard the Observatory, however, which confirmed that under certain circumstances, certain layers in the Sun's sphere could twist and flex, so that huge masses could actually be thrown *backward* into a retrograde movement for a time before rebounding and resuming normal rotation. How *that* could possibly be, and *why* it happened, were—and are —mysteries for another day.

The months went by, the optical telescopes tracked, the radio telescopes watched, the ultraviolet and electromagnetic studies continued, the Sundrops went in.

Meanwhile, McPhee, the physicist, had gotten interested in the strong parallels between the work the heliosonics team was doing and sonar used by ships at sea. Ship sonar is divided into passive listening, and active "pinging," the sending out of a calibrated sound so as to reflect it off a target. Because the operators know exactly the nature and origin of the sound being listened for (since they send it out themselves), active sonar is far more precise than the passive technique. If your ping comes back two octaves higher with a gibber in it, you can compare it directly against the original ping anad immediately know a lot about the target and the transmission medium the sound had passed through. Our "sonar" work was passive—but McPhee thought it could be made active.

But McPhee was a classic case of a man too long in the ivory towers of academe. He was a pale, short, scrawny fellow with a bushy head of hair and a beard to match, given to abrupt outbursts of enthusiasm and broad, sweeping gestures of his arms that threatened any small, fragile objects nearby.

But more than small and fragile things were threatened by McPhee's "Pinger." He asked me down to the physics lab one day to get a look at it. When I arrived, he urged me in, physically dragging me into the center of the room, where a standard Sundrop shieldcase had been opened and emptied of its instruments. In its place was a tangle of components hay-wired together. It took me a moment to spot a heavily modified fusor engine pulled out of a Sundrop, the nozzle removed and replaced with a containment unit. "There you are, Professor Ellis!" McPhee said. "The Solar Pinger. That will develop a precisely calibrated shockwave that should be detectable thousands of kilometers away. Perhaps tens of thousands!"

I stared with the hackles rising on the back on my neck. McPhee had put together a mid-yield fusion bomb. "McPhee," I said, as calmly as I could.

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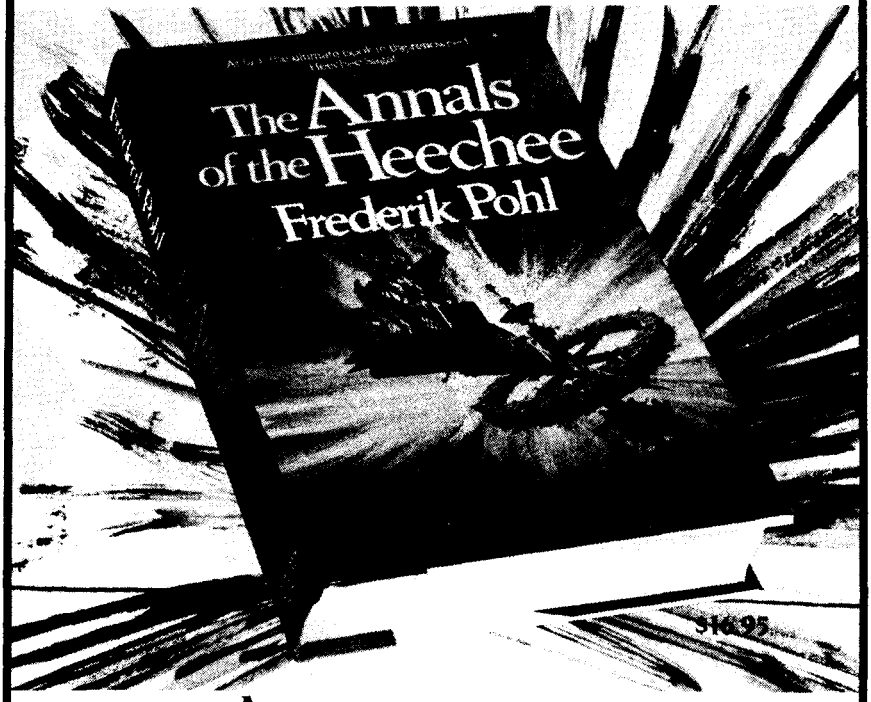

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"That's fine. *Now take that damn thing apart before you vaporize the Observatory!*"

I told Jason about it, and to my surprise he took the idea seriously. "If McPhee could build some of those with some decent safeguards on them, and we could put enough Sundrops down to make it worthwhile, bracket over a wide area, we'd *have* something!" he said. "We could get a good map of the underlayers." He paused and thought for a moment. "But we couldn't get the Pingers deep enough to do any good. They'd be vaporized in the upper photosphere like the Sundrops. Too bad."

It didn't seem so bad to me. Thankfully, I left the plans for the Pingers in the files and we muddled along with less exciting ways of examining Sol.

We bracketed the whole surface of the Sun with probes, watched it endlessly with our thousand glass and metal eyes. In the first three months of operation, the Solar Polar Observatory learned more about the Sun than had been discovered in all prior human history.

Jason and I had fallen into the pleasant habit of having lunch together on Tuesdays. What significance he attached to it I do not know, but invariably we sat at the table we had shared with his brother, so long ago, and so many millions of kilometers away. He was always bubbling with enthusiasm for one project or another, but on this particular afternoon, it was not a new instrument, or a specialized filtering program that divided out one Sun-sound from the others, but a whole new departure.

"Joseph," he said. "I think I know how to give twenty to forty hours warning of a major flare."

I looked at him sharply. If he were right, it would be a breakthrough—more than a breakthrough, a lifesaver. Smaller spacecraft simply could not carry the massive shielding needed as protection against the hard stuff a bad flare could throw. Every year, people were caught in small craft or in unprotected pressure suits and killed by flare radiation.

"How, Jason?" I asked eagerly.

He grinned broadly. "Sound. Listen." He dug a recorder out of his pocket and offered me the earphone. I took it and hit the play button. I heard a deep, roaring, blare of noise that gradually climbed the registers until the avalanche sound transmuted itself into a bull roar, then into the high-pitched cacophony of glassware shattering. It reached higher still, until it climbed into the noiseless keening of the hypersonics, and then the whole thing started over again. "We've heard that lovely little sequence four times," Jason said, "and every time a major flare has belted loose soon afterwards. Whatever it is, deep in the Sun, that causes the flares also makes that noise. We can use frequency-shifting—the doppler effect—to get a fair idea of the direction it's headed. If it's pointed toward Earth's piece of sky—we let them know."

"That's wonderful, Jason."

"*Someday* it will be wonderful. The trouble is there have been *eleven* healthy flares since we've been here. We missed predicting the others because we weren't lucky enough to have a Sundrop down there at the right moment those other seven times."

"Mmmph. Thinking on it, your luck

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has actually been damned good. How long has the average Sundrop been lasting?"

"Once it punches through the chromosphere and hits the photosphere, four minutes. Five if it can hold up in the temperature-minimum zone for a while. And we're dropping one every twelve hours. Not good coverage. But this little song—" he waved the recorder— "is a clue. Maybe we can backtrack from it and find other correlations, other solar events that can serve as warnings. Either that, or we need probes that can happily float in a six thousand degree plasma indefinitely."

I smiled at that fantasy. "We'll, we'd best bumble on with the technology we've got," I said. Flare prediction would be splendid, though it was not yet to be.

But Jason was a spacer; it was *his* people who died under the hail of atomic nuclei that blasted out from the Sun during solar storms. The billions on Earth were safe under their atmosphere and the Van Allen belts, and the thousands in the Low Earth orbit facilities were also at least partly sheltered by the Van Allens, The colonists on the Moon and Mars were safe inside their rockwall caverns. All that was no comfort to the people in the high-orbit habitats and spacecraft, Jason's folk. I could see that he was determined to press forward, searching for the answer.

We were near the peak of the Sun's basic eleven year "sunspot" cycle. Of course, it wasn't just the sunspots that came and went with the years, but those dark patches on the sun were the most visible evidence of the still-mysterious underlying cycle. But the level of activity on the Sun below was almost unprecedented in the centuries since the first careful observations were made. There were endless flares, sunspots, prominences, and other disturbances. The Sundrops went in, recording it all, and the Observatory-based instruments watched the rising turbulence in the granule and supergranule formations that bubbled and seethed on the surface of the photosphere. The Sun was growing angrier, almost hour by hour.

And there was another change taking place, at the poles: the Polar Depressions were deepening, broadening, changing. With every pass over a pole, those inexplicable, once-featureless craters were larger, and they were beginning to show structure, very strange structure: rippling, swirling, striations that spread inward from the lip of the craters. Soon the vast depressions were wide enough and deep enough to swallow the Earth, and they continued to grow.

Jason was blessed and cursed in his searches by the Sun's own violence. There was much solar activity to study, but the flares and prominences were killing more people than ever—eighteen in one week alone. We in the Observatory, behind our heavy shielding, were safe from anything short of a nova, but the vast majority of spacecraft, and even some space habitats, simply didn't have the shielding to protect their people. As the Sun grew angrier, some habitats were evacuated, and several spacelines canceled long-haul passenger and cargo runs.

A few damned fools blamed *us* for the increase in solar activity, claiming that the Sundrops had contaminated the

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Sun, introducing foreign elements into the hydro/helium mix. (The Sundrops were innocent, of course: After all, the Sun had been struck by megatons of micrometeroids every day for billions of years before we ever showed up.) Fortunately, few people took this idea seriously, or there could have been some extremely nasty publicity.

Even so, against all logic, we aboard the Observatory were frightened by the Sun's behavior. Our meters-thick shielding and super-efficient cooling system were not even strained, so far, but it was still unnerving to look through the monitors at a Sun the size of five hundred full moons, the entire surface boiling like a witch's caldron. And the Polar Depressions continued to grow and deepen, their structure becoming more and more complicated.

But Jason didn't seem to notice such things. He was intent on the search for the source of the FPSS, the mad-bull-in-a-china-shop noise of a Flare Predicting Sound Sequence. He had established that it promulgated itself throughout the photosphere. Traveling through the vast expanses of the solar interior at the speed of sound (which speed varied widely in the shifting pressure zones), it would never be heard at the same *time* across the entire photosphere, but at any one point it would last for about 150 minutes, somewhere between 15 and 36 hours before a major event.

Jason's doppler-analysis was improving, and he was now able to predict, with a fair degree of accuracy, where on the Sun the event would take place. Perhaps most important of all, he had the first clues as to how the prominences and flares happened. The sonics team had impressive proof of a heretofore unknown convective layer deep inside the Sun, which seemed to be the source of the sound. Furthermore, portions of this zone seemed to swell up, compressing the gases around them, just before an event.

Jason's sonics team did not have enough Sundrops to provide constant, reliable flare-watch coverage of the Sun. That would require launching Sundrops about every twenty minutes, exhausting a six-month supply stock in a week. Even if the Observatory did launch that many probes, we simply didn't have staff, the computing facilities, or the telemetry reception capacity to handle that much incoming data. The best Jason could do was to transmit warnings when a Sundrop *did* hear an Earthspace-threatening FPSS.

It was a big event when the first alert went out, accurately warning against a major flare through every space emergency warning system and crash channel. I thought Jason would be pleased, but he was anything but.

He was visibly upset when I showed him the newsheets and videonews about the warning. Jason's picture was prominently featured in all of them, and at first I thought he was simply annoyed by publicity he didn't want. But his concern went much deeper than that. He was convinced that the highly publicized warning could put a lot of spacers *in* danger. The rumor mills would report our success at prediction, and never hear that we could not predict *all* the prominences, that the absence of a warning did not mean space was safe. They would just assume everything was fine if nothing came through the crash chan-

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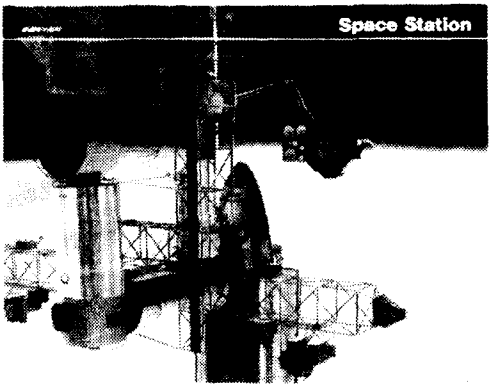

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nel—then get ripped up by gamma rays and x-rays and hard particles the next time the sonics team missed a FPSS sequence. And Jason knew his spacers: within five days I saw at least three press reports describing spacers who took no precautions against solar flames because they had heard no warnings.

Jason began to put the pressure on his team to develop a reliable flare prediction service, and they were close to a solution. More and more evidence —heliosonic, helioseismologic, optical and x-ray observation, filtergrams —pointed to the deep convective underlayer as the source of major flares. The FPSS was almost certainly caused by an eruption in the underlayer, the actual birth of the flare, long hours before it managed to boil up through the photosphere and escape into space. But there were hints of strong—if rather complex and indirect—correlations between certain sound patterns of some days duration and the pressure build-up *before* the flare cut loose. If we could get a clear understanding of the *structure* of the underlayer, we would have a solid chance to run computer simulations and interpret the pre-flare sound patterns.

But the pre-flare sounds lasted for upwards of sixty hours, and were complex and faint. With the little we knew, it was impossible to take the three- to five-minute snatch of sound a Sundrop heard before it vaporized and see if it matched up somewhere inside that sixty-hour song. But once we *could* do that, we should be able to predict the time, place, and intensity of virtually every flare.

But to get to that stage, we needed more data, but getting it required using the Pinger—and *that* would have to wait on the development of a shield-case that could survive long enough to penetrate that damnable convective underlayer.

There matters stood for several weeks, as our supply of Sundrops slowly dwindled and our public image rose and fell, not with the number of flares we could hear coming, but with the number of casualties caused by flares we unavoidably missed. In trying to learn about the flares, we were expending our probes at the rate of one every ten hours, instead of the planned twelve.

One fine day, I checked and found we had only about fifty Sundrops left. More, of an improved model, were being manufactured and would be shipped to us soon, but that did us little good at the time. We could do little but husband the Sundrop probes we still had and wait for the new shipment.

And then it happened. We rode our orbit up over the North Pole, looked for the North Polar Depression—and found it missing. More accurately, the Depression had transmuted itself into a knotted, twisting monster, carving itself deeper and deeper, driven by the mysterious patterns of the Sun's mad, complex rotation. The strange striations resolved themselves into a weirdly familiar shape, a mighty form that had awed and frightened humanity since we first learned to look down at our own world from space.

A hurricane. The twisting, whirling crater at the North Pole of the Sun had transformed itself into a hurricane, a typhoon of hydro-helium, a vast cyclical storm bigger than a planet. And the eye of that hurricane sat square on the North

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Polar Axis, a deep vertical tunnel, a thousand kilometers wide, boring itself deep into photosphere.

A hole in the Sun.

The Observatory was instantly a madhouse, a tangle of specialists falling over themselves to reach their instruments and examine this incredible storm.

I rush to the main control room with the rest of them and took my place of privilege at the central operations desk. All around me, men and women were scrambling through the hatches to their stations, rushing to get their instruments running, frantically hurrying to record the incredible scene.

I watched on repeater monitors, staring at that monstrous storm. I flicked through the filter controls, looking at it in a dozen different slices of the spectrum. The storm hung there, dark and angry, glowering at us, a raging knot of power and fire. No humans had ever seen such a thing. It was tempting, frightening, seductive, to imagine that this was the first time such a maelstrom had ever occurred, that this spectacle presaged the death of the Sun, the nova that would engulf Earth. But until now, the Solar Poles had always been hidden to human observers: No one had ever been over the Pole at the absolute height of the sunspot cycle before. The odds were far too great, the coincidence far too unlikely for me to believe this was Götterdämmerung: This had to be a normal part of what the Sun did every eleven years. Even so, staring into that fiery eye, it was hard not to imagine the end of all things was near.

I shook myself and asked the computer for a temperature analysis. I swore at my terminal when the overloaded system, besieged by dozens of users simultaneously demanding this or that bit of information, hesitated a moment or two before throwing a 3-D thermo-chart in front of me.

I sensed someone behind me, and knew who it was. Jason.

And with a stomach-knotted intuitive leap, I knew what he was thinking of. The *Argo*. I turned to look at him.

"Joseph. The *hole!*" he said. "It's like the eye of a hurricane, a zone of dead air. Extremely low pressure. Almost a vacuum—and it's *cold*, Joseph! It must be three thousand degrees colder than the surrounding walls of the storm! And it's deep, far, far deeper than any break made by sunspots, deeper than the FPSS convective underlayer."

"Jason," I said quietly, "Don't. Don't even think what you're thinking."

His eyes were bright with excitement, and he went right on, as if I hadn't said anything. "It's too late to try for *this* pole, but if this has happened to the South Polar Depression as well, we've got to get some Pingers ready. We can drop them through the cold of the hole and get them deep enough to get into the underlayers. Then we drop every Sundrop we've got, in a grid that blankets the whole region. Never mind the convective layers—This is our chance to see halfway to the core!"

I knew the station, I knew the equipment, I knew the probes. I knew instantly there was only one way those probes could be launched with enough accuracy to do any good. I should have spoken again, right then, said no firmly and at once—but instead I looked Jason in the eye.

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Our gazes locked for the briefest of moments, but his face told me all. Excitement, daring, challenge, defiance all played about his firm gaze and the set of his jaw. And I knew he had *planned* on finding a chance like this, had long dreamed of the wild chance that would give him a prize, an adventure and a journey that none could take away.

He looked at me, grinning, then turned and started calling out orders to men and women who had learned to trust him, obey him. "Wilton! Stop all launches of the Sundrops! We're going to need them. We'll need a good big chunk of the computer to run some trajectories—Ling Yee, see if you can get it for me—and everyone, pull in your data but if it doesn't need analysis now, do it later. We'll need the mainframe computer as clear as we can get it, so log out if you can run off locals." Jason sat down at a terminal himself, and quickly ran through some complex calculations—orbital trajectories, no doubt. While the program was running, he called McPhee over anad talked to him in low tones for a few moments. McPhee nodded eagerly and hurried off.

I knew what Jason had in mind, but I could not stop him. I could not be the one who stole this dream.

We had very few Sundrops left, and would have fewer still once McPhee got through cannibalizing some of them to make up the Pingers. But quantity wasn't the problem: targeting was. Even at maximum launch velocity, it took almost four days for a Sundrop to travel from the Observatory's orbit to the chromosphere, and our aim was none too good. Frequently, thrown and buffeted by the Sun's outer atmosphere, the Sundrops hit a thousand kilometers away from where we wanted them.

That meant that vectoring the Pingers and Sundrops in precisely from the Observatory was going to be nearly impossible, and Jason knew that. He watched the computer screen flash up its numbers, nodded in satisfaction, then slapped at the intercom and shouted out loudly enough to be heard in the operations room as well. "This is Alcott. I'd like to call an emergency meeting of the entire Sundrop staff in meeting room B right now. We need to discuss the best way to get some data." Without another word, he turned and headed out toward Room B.

Unbidden, I tagged along, leaving behind the incredible sight of a star with a hole in it.

The room was full to overflowing in a matter of minutes, and not just with the Sundrop team. Everyone who could possibly squeeze in was in there. The whole Observatory knew something was up. "Okay," he said. "We've all seen what's happening down there. If it's going on over the South Pole too, we've *just* got time to get a good look at it—if we run like mad. You all know the limits of the Sundrops. We can't fire them or the Pingers blind from the linear accelerator and have a prayer of hitting the South Polar Hole. We don't have the accuracy—we've never needed it before. And we don't even know for sure if the South Pole has a hurricane, or what stage of development it will be in when we're over it. We have no way of knowing how deep the eye, the hole, will be—it might be as big as the one we've seen, or it might have closed for another eleven years, until the peak of

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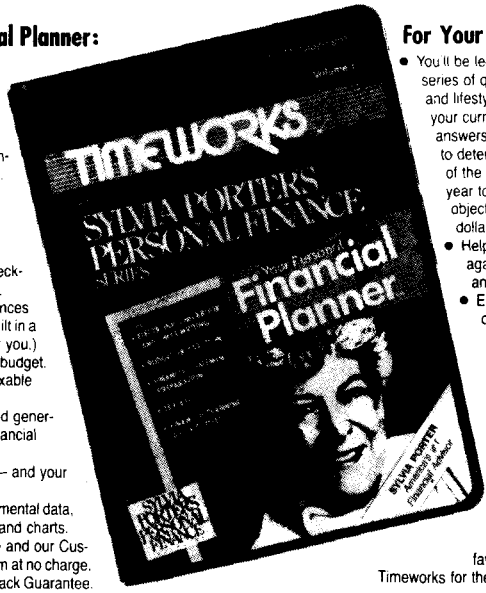

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the *next* cycle. We can't possibly fire blind at a hypothetical polar hole from around the limb of the Sun four days in advance. We need local control.

"For that, we have the tug, the *Argo*. She's even more heavily shielded than the Observatory itself. She has the delta-vee and the thrust-to-mass ratio to go from here practically to the Solar surface, and then return to the orbit of the Observatory. And those aren't paper claims. I know they're real—I oversaw the specs for her, and the design. She has cargo clamps to carry sixteen Sundrops. The Pingers are the size and shape of the probes, so they can be carried as well. So we've got a ship. I've run some rough numbers, and I can launch two days from now, time to get hardware rigged. I can arrive at the Pole just as the Observatory comes overhead, and release the probes where and when they'll do the most good."

Jason sat and calmly looked about the room. He could read in the faces the same thing I could: They knew he was right, we had no choice, we had to send him down if we wanted any hope of using this fantastic opportunity to see inside the Sun.

None of us had the courage to say no, to say that Jason's bravado and our curiosity weren't worth the risks. It was easier, simpler, more exciting to say yes.

In the whirlwind of frantic planning, Jason's decision to cancel the regular Sundrop launches was a small, obvious, unquestioned act. Certainly hitting the storm would gather more and better information than a few more routine preprogrammed drops. And yet, I firmly believe that the final disaster turned on that decision—or perhaps, more accurately, that *lack* of a decision—to cancel the 'Drops.

And there was time between that failure and its consequences; just the wrong amount of time.

Meantime, *Argo* was prepared.

Twelve Sundrops and four Pingers were bolted to her cargo clamps. Her tanks were topped off. Extra shielding was installed, and her experiment bays were jammed full of cameras, sensors, recorders, samplers, magnetometers. Programmers on the Observatory and back on Earth raced against time to feed her navigation computers with all the families of orbits and maneuvers she might need.

Argo's comm channels were beefed up as much as possible, to allow *Argo* to serve as a relay station for the data coming from all the 'Drops.

Jason was in the thick of it all, bustling and rushing about, full of exuberance and joy. It was as if he had *decided*, rightly or wrongly, that this mission was his destiny. All his life, all his dreams and ambitions, focused down to this grand chance to do what no man had ever done. Jason dove in head first, most eagerly, to accept this adventure fate had offered. He was alive, happy, excited. His round face smiled constantly, his expressive hands danced in the air as he explained some complex issue or asked what he could expect as he passed this altitude or that.

I have thought back on those brief, mad days a thousand times. I have searched my memory for a clue to what Jason did. But I have not found such a

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clue, for there were no such clues to be found. Jason—Jason was *happy* then.

All too soon, it came time for farewells. When all was ready, I saw him aboard *Argo,* the two of us squeezing into the tiny control room, the last jury-rigged sensors installed brief moments before. He grinned at me. "It's going to *happen,* Joseph. I'm headed in."

"Yes, Jason." I reached out my hand, awkwardly, and touched his shoulder. Then suddenly our arms were around each other, and the tears flowed unashamedly. "This is *yours,*" I said. "They can't take it away from you. *Never.* The first man inside a star. No one will be able to say you didn't do this thing, that you didn't deserve the right to be first." We let go of each other, and looked at each other. "This is yours."

Jason nodded, unable to speak for a moment. "You were always one I knew would understand, Joseph."

I took him by the hands. I felt—proud, fearful, reluctant, willing, just as I would be for the son of my flesh, for Jason was the son of my heart and hope.

"Godspeed, Jason Alcott."

"Godspeed, Joseph."

The hatches clanged shut behind me as the line-ac warmed up, and I was left with so much to tell Jason, and nothing left to say. Not long after, the whole Observatory shuddered for a moment as *Argo* leapt down the accelerator and toward the Sun. Her engines lit, and Jason reported all was well.

And then, out of our sight, out of our knowledge, on the other side of the Sun—a Flare. It exploded, leaping out from the underlayers. Gigatons of plasma-state hydro/helium, hotter than the core of the Sun itself, were thrown out of the Sun and blasted their way clear into space. Light, power, energies, complexities still beyond our full understanding blazed out into space, a cataclysm greater than all the disasters Earth has ever known, but scarce noticed in the surging hell of the Sun. The flash of light and radio and ultraviolet and gamma rays leapt across the firmament to be captured by the telescopes of Earth and Earthspace. Across that tiny bubble of populated space, alarms that were already too late blared and hooted and screamed their fruitless warnings. Already hard x-rays were coursing their way through fragile living tissue. Hard on the heels of the electromagnetic radiation came the torrent of atomic nuclei, hydrogen and helium atoms stripped of their electrons, smashing through the membranes of human cells. The nuclei ripped through electronic circuitry too, scrambling programs, blowing components, driving mad the computers that ran life support, propulsion, navigation.

People were caught in deep space, in small ships, far from any hope of shielding. People died.

And one of them was Cadmus Alcott. But we didn't know that then.

We of the Observatory, wrapped up in our frantic observations of the sun-cycle peak, only knew when Earth told us that a flare had happened on the other side of the Sun. Routinely, casually, we passed the word to Jason. It was a minor point, of no weight against our current efforts.

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But if we, in our excitement, could cease caring, Jason could not.

Argo, driving under constant acceleration, fell across the sky below, toward her appointment with old Sol. Aboard the Observatory, we watched the data pour in from *Argo*, and watched the orbit-plot diagram that showed tiny representations of the Observatory and *Argo* crawling across the northern midlatitudes, the equator, and the southlands of the Sun.

Below us, the face of the Sun seemed to be writhing with an insane, morbid, angry vigor as the eleven-year cycle reached its absolute climax. There, below us, the plages and spicules grew hourly in size and vitality, arcing prominences seemed eager to reach out through the chromosphere and corona to snatch us from the safety of our orbit. The helioseismologists watched the doppler shifts of the granules and supergranules in the photosphere, bubbling and boiling as they were driven by the roiling violence of this star's complex convection system, reverberating to the rhythm of the energies below. The thin, hot starblaze of the chromosphere danced before the pressures of plasma-hot gases.

There were no scientists left aboard the Observatory by that time, continue though we might with our recording and charting and our measuring. In every heart, cool-headed objectivity had given way to the most ancient and fearful awe of this titanic world. With the heretic Pharaohs, the generations of the Inca, with the makers of Stonehenge and the Hopi sun-dagger, we *worshipped* the life-giver, the life-taker, slavishly noting his every act, inscribing in our memory his every whim, staring in fascination at his terrifying strength and killing beauty.

And *Argo* was going down there. Her course would actually take her through the nominal limits of the chromosphere, inside the arc of the Sun, to be surrounded by the fires. Where the polar chromosphere usually was, now there was an almost perfect vacuum, the chromosphere's hydro/helium mix sucked down into the vortex below.

If the Sun had retained his normal shape, *Argo*'s planned course would have grazed the Sun at the pole; but there wasn't any Sun at the pole anymore, just a swollen, gaping crater.

More daring than the crater-dive was Jason's plan to attempt a forced orbit. He would use *Argo*'s engines to accelerate *toward* the Sun, pushing him down deeper into the hole, before reversing thrust to climb back out. The dive-burns would be working with the Sun's gravity, not against it, and the thrust levels required were surprisingly moderate, no more than four or five *gees*. It seemed terrifying, insanely dangerous, and yet every indicator, every calculation, said there was a margin of safety, albeit a small one, for the dive into the hole.

If the hole was there at all. We still didn't know. We would see the pole before Jason did, and the proper abort sequence programs were already loaded into *Argo*'s computers. A dozen times, a hundred times, I wished for the power to reach out across the millions of kilometers and throw the right button to bring Jason back. But it was out of our hands.

So we watched and waited. It seemed incredible that it could take so long for

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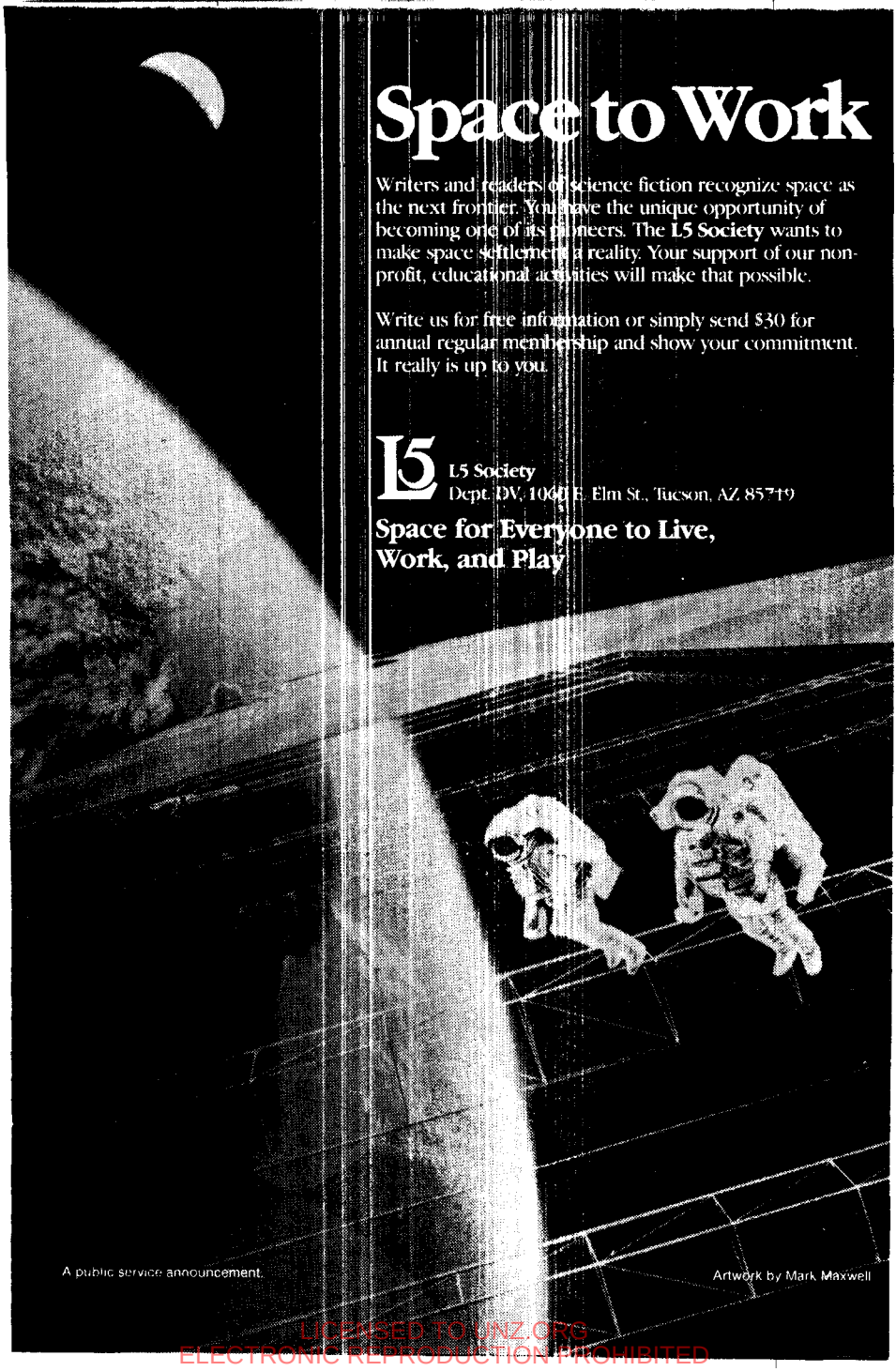
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Jason to travel to the swollen Sun hanging so huge and close in our sky, but even the shielded Observatory dared come no closer than 15 million kilometers to Sol. *Argo*'s power and speed might be great, but the distance she had to span was greater.

And then, five and a half days after we had first seen the Northern polar storm, the Southern storm hove into view—huger, higher, deeper, whirling faster than the Northern storm, the eye at its center opening wider and hungrier.

The hole was definitely there: No abort command was needed, *Argo* rode a forced orbit in.

Eager to be part of what was going on, I used my director's prerogative and took the spacecraft communicator's slot some time before the actual run into the hole. Three hours before his entry into the sun-storm's eye, Jason called. "This is *Argo* to Observatory." His voice came through clear and calm. "Looks like I've got a big piece of nothing right at the bull's-eye. Ship temperatures look good, cooling laser functioning at seventy-five percent capacity, all systems go. All the recorders are working like mad, I'm riding the preprogrammed course and just sitting here watching one hell of a show. Request that you pipe me any info on the recent flare. Did it do any damage?"

"I'm afraid so, Jason," I said. "I'm keying up our data, some Earthside observations we've been sent, and we've also got some newsfiles on it. I'll transmit it on slow scan." I didn't know what was in those files. I didn't know anything was wrong.

Millions of kilometers separated us from Jason, and it was many seconds later before his reply came back. "Thank you, Joseph. I'm going to give you the outside video now." A new and awesome sight popped up on my monitor screen, a close-in oblique view of the massive storm, a blood-red plasma-scape of impossible energy and violence. The movement of the storm clouds was plainly visible, and to be seen at this distance, at this scale of sizes, the cyclic storm must have been whirling at tens of thousands of kilometers an hour, so fast that our theories will have to be rewritten to explain how such speeds could be.

Aboard the Observatory, all was going well, and the excitement was a tangible thing. Jason could and would safely intrude into that remarkable zone of quiet and stability in the eye of the most violent storm ever witnessed. It seemed that the Sun could not kill him, after all.

And then I happened to glance down from that magnificent violence to another screen that was echoing the newsfiles being transmitted to Jason. The headline jumped out at me.

CADMUS ALCOTT, 8 OTHERS, KILLED BY SURPRISE SOLAR FLARE IN SPACECRAFT ACCIDENT

Instinctively, my hand reached out to hit the cut-off that would kill the transmission to Jason, but it was already too late. He would see the headline; the story could be no worse. I drew back my hand, let the file scroll on. I read the story that retold what the headline said so starkly, offering the compelling, useless details. How, when, between which stations at what time—none of which would bring them back.

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The signal to *Argo* leapt out across the millions of kilometers, hung in the vacuum for long seconds between Observatory and *Argo*. More long, deadly seconds lumbered past before Jason could read the words, and react. I turned my eyes back toward the *Argo*-exterior-view monitor, as if it could hold the answers. All too soon, it did, and the voicelink speaker came to life.

"*Argo* here." Jason's voice was angry, controlled, grim as it went echoing across the control room. "*Damn* it, Joseph. You would not have sent those newsfiles if you had known what was in them. Why did it have to be you who told me this?"

Everyone in the control room looked from me to the speaker. Fingers danced over keyboards to pull up the newfiles, muffled exclamations and curses floated up from dozens of my colleagues as they found the headline. In ten seconds everyone knew what was going on.

"Jason, I'm sorry. I did not know, and I beg your forgiveness," I said into the empty air and the soulless microphone. A knot of fear began to tie itself around me. My pointless apology crossed the monstrous distance, and Jason spoke again before he possibly could have heard my words.

"Right now, you're probably trying to say something comforting, and I'll hear it in a few seconds. But my brother would still be alive if I hadn't canceled the regular Sundrop pattern so as to have enough probes for this little glory jump of mine. We'd have spotted that flare, been able to send a warning. Tell me something comforting enough to handle *that* and I'll listen. *Argo* out." The speaker fell silent, and, the twisting hell of the hole leered at me from the monitor. I stared at that hypnotic whirlpool for long seconds, trying to believe that Jason was down there, inside it, already—

I rattled nervous fingers over my keyboard and called up the mission-event queue. He could still bail out, there was still time, and I was not going to let him fly such a frightening deadly, complex mission bathed in guilt over a hated brother's death. "*Argo*, you are ordered to abort. You have an abort window opening at fifty-nine hours, twenty-four seconds into the mission, about ten minutes from now. You are ordered to load and run the abort sequence." And I heard myself saying to him, not so long ago that *No one can take this away from you*. Even as I spoke, I felt a traitor, and even as I felt guilt over that, I prayed now that it *could* be taken from him. "*Argo*, please acknowledge."

But only silence came.

"*Argo*, this is Observatory control. I order you to abort and return to base. Acknowledge signal."

Silence, nothing. He had slipped our bonds, and flew on to touch the Sun-god's face. We were all of us helpless to do anything but pull in the data, the images, the readings, the sounds that his craft sent us. He was going on, going in, and he refused to let that be taken away.

And that awesome, frightening moment came when *Argo*'s cameras had to pan *up* to look at the top of the Sunstorm. Jason was inside, and going deeper. I ached for a way to make him stop, to call him back, to pull him from danger, and yet I gloried in his adventure.

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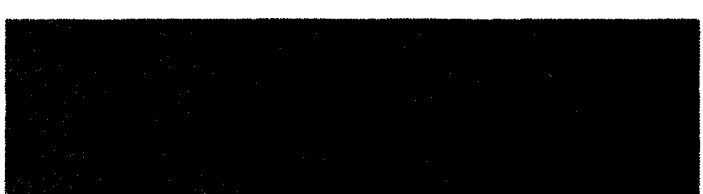

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"Sundrops away," a technician called. "Due to speed of light lag, I am reading in signal-received time, about thirty-five seconds behind transmission. Looks like he dropped Sundrops about three hundred klicks deeper than planned. That'll mean some real good data, but c'mon, Jason, don't go playing hero. Okay, we should be getting—yeah, there's the Pinger One drop. Plan is to drop the Pingers thirty seconds apart. Coming up on Two. Two away. Stand by for Three. Three is late. I say again, Three is—no, there she goes. Three dropped fifteen seconds late, two hundred klicks deeper than planned. Fourth and final—late. Waiting on Pinger Four. There she goes. Fifty seconds late, two-fifty klicks deeper. All four Pingers released, temp readings on all show them inside the photosphere. Coming up on programmed *Argo* engine stop."

This was the worst part. We on the Observatory could pick up the crude time-and-distance telemetry from the probes, but we needed *Argo* to be sure of getting all the more complex data signals coming in from all the probes at once. Her on-board signal processors would sort out the mish-mash of incoming stuff and integrate it into a single laser signal to us. But *Argo*'s fusion-engine plume would have effectively jammed the data signals, and so she had to shut down her fusion engines during the Sundrop run.

"Pinger One due to blow in twenty seconds."

The seconds took too long. Finally:

"Loss of signal on schedule from Pinger One. Presumed blown. There is L.O.S. on Two. Three. And there goes Four. Board shows nine surviving Sundrops. From the temp gauges, they are nicely spread across the various layers of the photosphere. Jason did some good shooting."

The Sundrop signals came in: light intensity, magnetic studies, spectral analysis—and the Sun's voice. I keyed into the signal from Sundrop One, which seemed to be closest to *Argo*. The shouting clamoring, cacaphonic song of the Sun blasted down on my ears, from the subsonic to the supersonic, roaring away. And then what we wanted came, strangely muffled and echoing, the sound knotted and tangled by the long kilometers and seconds of its path through the skin of a star, the dull, clumsy *boom* of Pinger One doing its job. Then Two, Three, Four exploding, the noise of the blasts reverberating, echoing across the maelstrom, finally fading away to nothing. *Argo* had done her job. I leaned back, closed my eyes, and sighed in relief. Now he could come home.

The human voice cut like fire: "I show no engine start on *Argo*." The telemetry officer's voice came in flat and hard, words said dutifully, unwillingly, as if her keeping silent would keep the news from being true.

I sat bolt upright and stared into the *Argo*-exterior monitor. Suddenly, my heart was pounding, my mouth dry. "Jason, get the hell out of there! Light that engine!" I told myself in fearful urgency. A dozen quiet, intense voices echoed my thoughts, chanting worshippers begging the Sun-god to let our friend survive.

I slammed my hand down on the voice-transmit button. "Jason! Relight your fusor! You are too low. Come

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back! Pull up! For God's sake, get out of there!"

I watched the *Argo*-exterior monitors, willing them to show a shift in motion, watching as the plasma-winds of that dreadful storm leapt closer and closer, rose higher and higher as *Argo* drew closer, fell deeper. One small opening in the stormwall swelled to become a massive, gaping hole, a serpent's mouth grinning wide to—

Argo and her pilot died together, mauled by the dragon's teeth of the Sun's fury.

The screens blanked, the readouts died, the command center took on the shocked silence of a great man's new-made tomb.

And there should have been something to say.

I was the one who attended to the dead man's effects, more out of duty than need, a thing to do and keep numb shock at bay. I realized I had never been in his cabin before, that no one had ever gotten past the antechamber: Jason had kept his room so artfully off-limits to others that we never noticed just how private it was. And so it was I found the greatest surprise of all, a portrait of Cadmus hung in a place of honor, a picture that so looked like Jason that I did not realize who it was at first. The same wolfish grin, the same delight in being alive, the same clear intelligence shining through. Perhaps the portrait explained Jason keeping us out of his cabin. Perhaps Jason was embarrassed to have the picture seen, evidence of his love for the family he claimed to have rejected. I looked at it more carefully. The glass was much smudged with fingerprints, as if Jason had often taken it down to look at it.

I sat in his chair and wondered.

Had he dutifully done his job down there, then blown the ship out of guilt, because he could have warned Cadmus if the Sundrops hadn't been saved for Jason's mad chase after glory? (But would the haughty Cadmus have deigned to heed the warning anyway?) Could Jason not bear the knowledge that he would be called back to the family, the knowledge that now he would *have* to go, and there would be no new escape from his family "duties"? Would his brother's death draw him inevitably back to the life in a gilded cage he had hated?

Had he merely become distraught, made a piloting error? Was he so intent over the data, the secrets he was learning, that his attention wandered? Had we who taught him to wonder and learn about the Sun killed him by tempting his curiosity too far?

Had the ship simply malfunctioned? McPhee said that the magnetic field strengths down there had been a hundred times what had been expected, easily strong enough to scramble a fusion engine if they hit the wrong way.

I sat there long, but life went on, and dully, automatically, I rose, replaced the photo, went back to my work, to do what my life and job expected of me.

When six days had passed, we were over the North Pole again. The Northern storm was dying when we crossed over it. At the end of six more days, we had circled the Sun altogether and were back over the South Pole. The Southern storm had vanished altogether, the holes in the

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Sun swallowed up by the fast-settling clouds of hydro/helium. Sol gradually descended back into slumber. Like a fly-trap that shuts up once its prey has taken the bait, the Sun tempted Jason in, swallowed him up, and was sated. One day, perhaps at the climax of the next cycle, Sol will tempt in the next victim, the next explorer. I hope I am alive to see it, and I hope the next journey into the Sun ends more happily.

I have had long days and years to think, now. None of the logical, possible, understandable reasons for his death satisfy. Yet one of them must, for there are no *other* explanations. Jason was too good a ship handler for it to be a piloting accident, *Argo* was shielded and functioning perfectly up to the last, and I cannot imagine Jason as a suicide. But what do I know of mechanical failures, of the workings of chance, or of the mysteries of a young man's soul? I think of his brother's much-looked-at picture and realize how little I knew him. What of the two of them as children? Had Cadmus been a god, an idol, to be worshipped by his younger brother? Had they grown apart, and bitter, as adults, though still irrevocably bound by the memories of childhood, knotted in a tangle of love and hate? Did each look at the other and hate what he himself could have become, even as he loved his estranged brother?

Or did Old Sol, jealous of his domain and angered by the hubris of this insolent whelp of the third planet, simply reach out a negligent finger and flick Jason out of existence? It is a distinct effort to recall that the Sun is a star and not a God, that the idea of an inanimate lump of gas feeling anger is mad. Still, I prefer that idea to thinking Jason died by his own hand.

I know that I must abandon the fruitless question of why Jason died and marvel at the fact that this splendid young man lived.

And I must remember he lived *well*. Impoverished of human contact, his wealth denying him his dreams, he threw away his bounty and then gave of himself, and so made himself rich. He was loved in life, is mourned and admired in death. He led us to great knowledge of the brooding, glowing sphere that suffers the rest of us to live. In life, I loved him as the son I never had. In death, I must love him as the sort of hero humanity will always need.

But every day, I look out across the angry, mottled face of the star I have studied all my life, and know that, for the rest of my time alive, I will hate that cruel master, that jealous Sun that killed him. ■

● We are all omnibuses in which our ancestors ride, and every now and then one of them sticks his head out and embarrasses us.

Oliver Wendell Holmes, Sr.

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Jay Kay Klein's biolog

Being a cover artist for *Analog* didn't only require that you were good, you also had to live close enough to New York City to consult with the art director. David Hardy was the first artist to live as far away as England and still claim a cover, for the June 22, 1981 issue, shortly after Davis Publications became the parent company. This illustrated the article "Mars in 1995?" by Bob Parkinson, a Ph.D. member of the British Interplanetary Society. He had intended it for the Society's journal, but David talked him into trying for a wider audience in *Analog*.

His interests started out equally divided between art and science, and he even worked in a laboratory for a couple of years before meeting Patrick Moore, the astronomy writer. Moore's *Suns, Myths and Men* became David's first illustrated book, for which he turned out eight illustrations in five days.

After the RAF, David worked nine years as a commercial artist for Cadbury's, the chocolate manufacturer. He went full-time free-lance following work on *2001*, and already had many credits in books, magazines, comics, and TV. Until 1970 he thought of himself as purely a space artist, being greatly influenced by Chesley Bonestell. Then he did work for a British SF magazine and soon American magazines except *Analog*. Once started, he quickly became popular at *Analog*.

Like practically everyone who enters a life-long love affair with science fiction, David started reading it as a teenager. When he ran across SF magazines in a news store at 14, he started producing cover art, which he would have sent to a publisher if only he knew how to do it. His first SF convention came in 1957 and he attends British events regularly. He has been a chairman and secretary of the Birmingham SF group for several terms. Nomination for a Hugo came at the world SF convention in 1979, he was guest of honor at the Stuttgart convention in 1981, and in 1984 was voted Best European SF Graphic Artist at Eurocon.

His particular mediums are gouache and acrylics, and the airbrush. What he likes best of all is writing and illustrating books of his own, bearing titles like *Air and Weather, Light and Sight*, and *Energy and the Future*. His earlier *Atlas of the Solar System* was brought out in an updated edition last year by British publisher Octopus. His paintings have wound up in the possession of Isaac Asimov, Arthur C. Clarke, Carl Sagan, and Wernher von Braun. He has been exhibited around the United Kingdom and Europe, with commissioned work appearing at the US National Air and Space Museum. Panoramas for 360-degree projection have been used at the London and Stuttgart planetariums.

David has been experimenting with computer-aided illustrations, some of which will appear in *Analog*, as for Sheffield's "Trader's Cross." David also writes short stories, with an ambition to do both a cover story and the cover. He notes that American authors generally produce better-researched hard-science stories than UK writers and thinks that's probably why his illustrations are particularly well received in the United States. ■

David A. Hardy

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Richard D. Meisner

UNIVERSE—THE ULTIMATE ARTIFACT?

Cosmology inevitably tickles the imagination by leading to questions for which human minds can't really picture any of the possible answers—and some of the latest speculations look curiously like some of the oldest!

Cosmologists sometimes try to envision, in their more imaginative moods, what things would be like in a universe fundamentally different from the one we find ourselves inhabiting. A natural approach to take to the problem is to consider the effects of variations in the magnitudes of the universe's fundamental forces and constants. These very important numbers may justifiably be called the "structural parameters" of the universe. Together, they completely determine the specifics of all physical processes and interactions occurring in the universe. Table 1 list the values of the most important of these constants.

The "fine structure constants" at the bottom of the table are of special interest, since they allow the representation of the four fundamental forces as dimensionless numbers. By "dimensionless," we mean that they don't represent a certain magnitude of meters, or kilograms, or seconds, or any combination of these, as the other constants do. The fine structure constants are deliberately put together in such a way that the units of mass, length, and time cancel each other out, leaving a number that's always the same regardless of the system of measuring units used. This convenient generality makes these numbers

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very popular among physicists.

What would be the effect of varying one or more of the fine structure constants by a few percent? Remarkably, it's becoming clear that small changes in any of the listed constants would result in a radically different universe, within which it would be virtually impossible for life to have a chance of developing. Among the vast spectrum of conceivable universes, there is only an infinitesimal bandwidth within which universes compatible to complex structures such as stable stars and life may exist.

These are strong words, expressing a finding which seems disturbingly anti-Copernican in nature. Could our particular universe really be so special, so privileged? Some respected scientists insist that it is, and their case is backed by compelling arguments.

First, a few quick examples to illustrate exactly why cosmologists are beginning to view a universe compatible to life as such a remarkable phenomenon.

THE STRONG FORCE

We'll begin by looking at the strong force—the force responsible for binding together protons and neutrons in the atomic nucleus. If this force happened to be only five percent weaker, it would be too weak to overcome the intrinsic quantum "jumpiness" of a proton and a neutron and bind them together. The deuteron (another name for the nucleus consisting of one proton and one neutron) could not stably exist. The deuteron is, however, essential to the first step of the fusion process in stars, the proton-proton cycle. In its absence, it's very doubtful whether stable, long-lived stars could exist at all. The other, more advanced fusion reactions in stars involve heavier elements, the existence of which derives originally from the proton-proton cycle. A weaker nuclear binding force thus means, ultimately, an absence of stable stars, and few if any elements more complex than hydrogen—the makings for a very dull universe.

As pointed out by Freeman Dyson, the implications are just as drastic if we consider a slight increase in the strong force. An increase of only about two percent would be sufficient to overcome the repulsion between the like charges of two protons and bind them together, in the formation of a stable "diproton." Isolated protons would tend to fuse very readily with each other, via the strong force, and it's very unlikely that an appreciable amount of simple hydrogen would have survived the initial hot, dense phase of the universe. All hydrogen would have fused itself to helium long ago. The implications: no long-lived, hydrogen-burning stars could exist, nor could any of the molecules necessary to the development of any form of life exist. Water, ammonia, methane, amino acids, proteins, nucleotide bases—all require the presence of hydrogen. A slightly stronger strong force leads to a lifeless universe.

STELLAR STABILITY

Another interesting example of the sensitivity of main sequence stars to the

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magnitudes of the fundamental constants results from an investigation of energy flow in stellar interiors. In stars of relatively high mass, heat energy escapes from stars mainly by radiation flow. Such stars are the so-called blue giants.

In the less massive stars, this process fails. The radiation can't be kept flowing fast enough to keep the surface of the star sufficiently hot, and instabilities set in, leading to the onset of convection. Now the heat energy, instead of being carried outward by radiation, is primarily transported by the less efficient convective transference of heat, from particle to particle. Stars in which convection provides the main energy escape mechanism are smaller and cooler than the blue giants, and are known as red dwarfs.

Interestingly, the mass of a typical star lies in the narrow range between radiative blue giants and convective red dwarfs. Astrophysicist Brandon Carter has shown this to be a consequence of a finely-tuned relation between the relative strengths of gravity and electromagnetism, the two most important forces in stellar physics. He derives the following remarkable equation:

$$\alpha_G \geq \alpha_e^{1/2} (Me/Mp)^4 \qquad (1)$$

(The sign separating the two sides of the equation means "greater than and about equal to.") For convectively stable stars to exist (that is, stars somewhere between the extremes of cool dwarfs and hot giants), the above relation must be satisfied.

Plugging in the values from Table 1, we obtain 5.9×10^{-39} on the left, and 2.0×10^{-39} on the right, very conveniently assuring the existence of stable, sunlike stars. Carter's delicate equation illustrates the fact that if gravity were slightly stronger (resulting in denser stars), or electromagnetism slightly weaker (resulting in less energetic radiation), all stars would be convection-dominated red dwarfs, too cool to support zones within which habitable planets could orbit. A correspondingly slight

Table 1: Fundamental Constants

Name	Symbol	Value
Electron mass	m_e	9.11×10^{-31} kg
Proton mass	m_p	1.67×10^{-27} kg
Unit charge	e	1.60×10^{-19} coul
Planck's constant	$\hbar$	1.06×10^{-34} kg • m²/sec
Gravitational constant	G	6.67×10^{-11} m³/kg • sec²
Speed of light	c	3.00×10^{8} m/sec
Weak force constant	g_w	1.43×10^{-62} kg • m⁵/sec²
Strong force constant	g_s	6.89×10^{-13} kg$^{1/2}$ m$^{3/2}$/sec
Fine structure constants:		
Electromagnetic	α_e	7.27×10^{-3} (dimensionless)
Weak	α_w	3.03×10^{-12} (dimensionless)
Strong	α_s	15.0 (dimensionless)
Gravitational	α_G	5.87×10^{-39} (dimensionless)

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change in the other direction, and all stars would be radiation-dominated blue stars, with lifetimes much shorter than the billions of years required for the development of complex life.

The remarkable way in which the values of the constants satisfy Carter's equation has left some scientists deeply shaken. As British cosmologist Paul Davies put it, "The fact that the two sides of the inequality are such infinitesimal numbers, and yet lie so close to one another, is truly astonishing."

NUCLEOSYNTHESIS OF CARBON

Much interesting and valuable research has been published on the theory of very exotic non-terrestrial biochemistries, and it's becoming apparent that few if any researchers would deny the importance of carbon for any viable form of life. The most detailed "exobiochemistry" I've come across (an ingenious model based on liquid ammonia as a solvent) still requires carbon in its alternate forms of fats, lipids, amino acids, carbohydrates, proteins, and nucleic acids.

As discovered by Fred Hoyle, the existence of significant amounts of this biologically crucial element has been dependent upon a curious coincidence, involving nuclear resonances within the stars.

Although phrases like "nuclear resonances" may be intimidating to some, the concept is really very simple. Nuclei, like electrons, can exist in a variety of discrete states according to their energy levels. Subject a nucleus to a certain amount of energy, and it will vibrate at a specific frequency; keep increasing the energy, and eventually the nucleus will jump to another of its possible specific resonance levels, and so on.

A fusion reaction (we'll denote it A + B = C) is said to be "resonant" when the sum of the energies of A and B lie just above the energy level of the nucleus C. Resonant reactions are known to occur with greater speed and efficiency than nonresonant reactions.

Now, carbon is produced in stars through a process called the triple-α reaction. When two helium nuclei (alpha particles) fuse to form an unstable beryllium nucleus, and a third alpha particle fuses with the beryllium before it can decay, you end up with a stable carbon nucleus.

During an extensive study of fusion in stars, Hoyle noted that the short lifetime of the beryllium nucleus demands that the triple-α reaction be a resonant one. If the reaction were not resonant, the yield of carbon would be negligible. Knowing that the energy of He + Be under the thermal conditions in a typical star was about 7.4 MeV, and observing the abundance of carbon and carbon-based life all around him, Hoyle predicted that the carbon nucleus, subjected to the conditions inside a typical star, must resonate at a bit above 7.4 MeV (thus allowing a resonant reaction). Of course, experiment later proved him right. Carbon has a resonance level at 7.65 MeV, nicely allowing an appreciable accumulation of carbon nuclei inside stars.

This, however, is only half the story.

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The fusion of an additional helium nucleus to the newly-formed carbon would transmute it to oxygen. If this type of reaction were also resonant, we could say farewell to all that valuable carbon. But by a further stroke of cosmic fortuity, the oxygen nucleus has a level safely below that of C + He, so that resonance doesn't occur.

The advantageous placement of these resonance levels are necessary and finely-tuned conditions for the existence of life in this universe. In principle, it should be possible to trace these coincidences (through complex and as yet uncharted pathways) back to the relative strengths of the strong force and electromagnetic force, which jointly determine the placements of the nuclear resonance levels. If the relationship between these forces was a bit different, this universe, lacking carbon, would lack any chance to develop the level of complexity characteristic of life.

SUPERNOVAE

Of course, no matter how much carbon accumulates in stellar interiors, we still require the supernova mechanism to explode it into interstellar space, making it accessible for the formation of planets and life. As it turns out, supernovae are sensitive to the magnitude of the most obscure of the four fundamental forces, the "weak" force, from which come the beta particles and neutrinos of radioactive decay.

A supernova typically begins with the exhaustion of the inner layers of a star, resulting in a rapid implosion. Most of the gravitational energy released in the process is transported outward in a rush of neutrinos, leading to an explosion of stellar material out into space. The magnitude of the weak force determines how strongly the neutrinos interact with the outer layer of the star. As shown by B. J. Carr and M. J. Rees, the relation to be satisfied for supernovae to be able to occur is:

$$GM_c^2/\hbar c \sim \alpha_w^4 \qquad (2)$$

If the weak force happened to be a bit stronger, the level of resistance would increase to the point where the neutrinos would lose their energy and momentum while still deep inside the star. They wouldn't reach the outer stellar envelope, and there would be no explosion of material into space. On the other hand, given a slightly weaker weak force, the neutrinos (which are quite ethereal as it is) would be unable to interact strongly enough with the stellar envelope to cause an explosion, slipping right through without much effect.

In either case, space would remain virtually empty of elements more complex than helium, eliminating any chances for the formation of planets and life.

IT'S NOT EASY CREATING A UNIVERSE

A common initial reaction to these types of examples is that perhaps there are very different sets of the fundamental constants which we haven't had the chance to investigate, capable of supporting complex structures like stars and life. But as the proverbial "perceptive reader" will have realized, the possibilities for re-engineering the constants with any hope of preserving an inter-

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esting universe are very slim, due to the tight interdependence of the constants' values.

Suppose we wish to design a universe with a different set of fundamental constants, in which stable stars and planets may still exist. Let's start with, for example, a stronger weak force. Since we want planets, we're going to want stars to be able to explode complex elements out into space. Hence, we'll have to increase the gravitational force, for the supernova condition (eq. 2) to stay in effect.

So far, so good. But remember, the existence of stable main-sequence stars demands a delicate balance between the gravitational and electromagnetic forces (eqn. 1). Our increase in the gravitational force thus requires an increase in the electromagnetic force as well.

But of course, if the electromagnetic force is raised, the strong force has to be varied as well, since that unique set of nuclear resonances allowing the accumulation and preservation of carbon in stars depends on the relative strengths of both forces.

And finally, we recall that changing the strong force results in either the instability of the deuteron (no stellar fusion, and a universe of nothing but hydrogen) or early volatile fusion of all simple hydrogen to helium (no long-lived stars, no organic or potentially organic molecules).

Our efforts to create an alternate universe capable of developing life meet with failure. Change only one of the constants a bit, and everything tends to collapse into an uninteresting mess.

EXOTIC LIFEFORMS

A second common reaction to examples of apparent "cosmic contrivance" is the argument in favor of extremely exotic lifeforms, able to develop independently of stars and planets. If "life" could exist under virtually any conditions, then we wouldn't be justified in considering a starry universe containing carbon to be such a special place.

But there are two important considerations to bear in mind. First, in many of the examples given above, a variation outside the allowable range results in a universe in which hydrogen and/or helium would be the only available elements. Specific plans for even a rudimentary biochemistry based only on these elements would be, shall we say, revolutionary. The degree of complexity required for life, much less intelligent life, just isn't easily come by with only hydrogen and helium to work with. Second, there exist a growing number of examples of cosmic fine-tuning pertaining not only to stars but to atoms themselves. As a quick example, cosmologist Paul Davies has noted that if the mass of the neutron were less by a few tenths of a percent, atoms probably couldn't exist. Presumably, even the most exotic lifeform would require the existence of atoms.

Although promising at first glance, the appeal to exotic lifeforms misinterprets the scope of the coincidences, and is too weak to explain away the appearance of remarkable fine-tuning in the structure of this universe.

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UNKNOWN LAWS OF PHYSICS?

Physicist Heinz Pagels exemplifies another common approach to the subject. Pagels expresses bewilderment at the growing interest in the subject of *cosmic fine-tuning*, the brunt of his argument being that future advances in unified field theories will probably reveal the values of the constants to be natural consequences of the laws of physics.

But although this is probably correct, it does nothing to diminish the enigma. The fundamental mystery is not how the constants came to have their observed values, but why those values turn out to be precisely those required for a life-compatible universe. If the constants are explainable by unknown laws of physics (as is probable), we are still left to wonder why the laws happen to lead to a universe compatible to life. Pagels's approach simply pushes the mystery back a step.

Moving on to the mainstream of current scientific speculation on the topic, two explanatory models are being discussed most frequently: the multiple-universe explanation, and the universe-as-artifact explanation.

THE MULTIPLE-UNIVERSES EXPLANATION

The fortuitous values of the fundamental constants do not seem quite so remarkable if we consider the hypothetical existence of a vast array of randomly different universes, collectively possessing all possible combinations of constants. In such a case, the existence of a life-containing universe such as our own, extraordinarily rare though it may be, is to be expected.

Indeed, there would seem to be some scientific basis for assuming multiple universes. Hugh Everett's Many-Worlds *Hypothesis is frequently invoked in this* context. Everett hypothesized (for reasons too involved to go into here) that the universe may, at every moment, be continually splitting into nearly identical copies of itself, resulting in an enormous number of separate universes.

Unfortunately, the bleak truth is that Everett's theory has gained much more acceptance among SF writers than among scientists (even widely-known physicist John Wheeler, an early staunch proponent, has recently withdrawn his support), and that even if the theory were proved correct, it would be inapplicable as an explanation in this case. Everett's hypothesis actually has nothing whatsoever to say concerning universes with different fundamental constants. The near-infinity of distinct universes obtained in Everett's hypothesis would be different only in the sense that different things happen in each one. But each of the many different "reprints" would be characterized by the same set of fundamental constants as the original.

Wheeler suggests a multiple-universes idea which would not be subject to such constraints. Perhaps, he proposes, the universe oscillates from big bang to "big crunch," with a random "reprocessing" of the constants during each collapse of the universe. During complete gravitational collapse, the laws of physics as we know them are transcended. Anything's possible.

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Even this model is subject to a simple objection, however. With a random reprocessing of the constants between universes, it's all too likely that eventually one would come along with a gravitational force too weak to cause recontraction. The universe would just go on expanding, and the cycle would be broken, probably long before an even slightly interesting universe had any chance to come into existence.

It seems neither of the two specific multiple-universe models published to date can help us to explain the many examples of apparent fine-tuning in the values of the constants. In addition to the shortcomings of these models, some cosmologists have criticized these types of attempts at explanation on general philosophical principles. For example, Davies: "Can we really believe in limitless numbers of universes, created but never observed, serving no purpose except to ensure that, somewhere among the vast array of wasted worlds, will be the occasional cognizable accident? To explain the coincidences by invoking an infinity of useless universes seems like carrying excess baggage to the extreme."

UNIVERSE AS ARTIFACT

Some who have examined the consequences of slight variations in the values of the constants have given serious consideration to the inference that the universe is the artifact of extrauniversal intelligence. (Just as "extraterrestrial" means "beyond Earth," I use "extrauniversal" to mean "beyond the universe".) The discoverer of the carbon coincidence, Fred Hoyle, is perhaps the best-known exemplar of this interpretation, having argued that: "A commonsense interpretation of the facts suggests that a superintellect has monkeyed with physics, as well as chemistry and biology, and that there are no blind forces worth speaking about in nature." Fellow British cosmologist Paul Davies agrees, writing "It is hard to resist the impression that the present structure of the universe, apparently so sensitive to minor alterations in the numbers, has been rather carefully thought out."

The appeal of the universe-as-artifact hypothesis is readily understandable. It is direct and simple, asserting simply that the universe appears intelligently designed because it was intelligently designed. This perspective also goes far toward explaining why mathematics, a product of pure intellect, applies so universally to the physical universe. Physicist James Jeans observed decades ago that ". . . the universe appears to have been designed by a pure mathematician."

One may feel inclined to apply the word "God" in this context. This is justifiable, although I tend to avoid the word simply because I've found almost without exception that it triggers an immediate positive or negative emotional response in the listener—most inconducive to good scientific thinking. Naturally, the artifact hypothesis is most attractive when stripped of its unfortunate historical trappings of superstition and dogma.

If the universe is indeed an artifact, some would object, isn't it a bit ov-

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erdesigned? We would seem to have a case of cosmic "overkill" on our hands, with immense portions of the universe apparently going to waste.

But an interesting insight by physicist R. Dicke puts things in a different perspective. Dicke would have us consider the following chain of requirements: 1) Intelligent life requires habitable planets. 2) Habitable planets require stars which remain stable energy sources for billions of years. 3) In an expanding universe, several billion years are available only if the density of the universe becomes very low, with a radius at maximum expansion of several billion light years.

Hence the overwhelming size, age, and emptiness of the universe, far from being indications of the insignificance of intelligent life, are in fact prerequisites for the existence of such life.

In addition, I've always felt it very likely that eventually virtually all matter and energy in the universe will be purposefully harnessed by intelligent life (perhaps our own descendents). Terraforming will bring life to increasing numbers of lifeless planets, Dyson spheres will enclose increasing numbers of stars to collect their entire energetic output, etc. All that presently seems wasted in the universe will surely become incorporated eventually into the evolutionary flow toward greater degrees and domains of ordered complexity. The "overkill" argument doesn't apply, in the very long-range perspective.

To date, no other rigorous objections to the hypothesis of extra-universal designing intelligence have been raised. Of course, the hypothesis is (at present) based primarily on circumstantial evidence, and is arrived at largely by process of elimination. Stronger evidence (although still only circumstantial) would come through scientific verification that consciousness can exist independently of spacetime and the laws and constants of physics, and can in itself influence matter and energy. Perhaps the embryonic science of parapsychology will shed some light on such questions in the future.

It's interesting to note that the general universe-as-artifact concept has enjoyed the intuitive support of the greatest scientific minds of all ages—Kepler, Pascal, Newton, Planck, Fuller, and Dyson, to name a few. And of course we may add Einstein to the list of scientific geniuses who have expressed a tendency toward a belief in extrauniversal designing intelligence: "I want to know how God created this world."

Personally, if the artifact inference proved true, I would be most interested not in HOW the universe was fabricated, but WHY. Is all the world a stage, upon which we entertain Higher Intelligence? Or is the universe intended to entertain us? Is it some form of intelligence test? Or simply a vast experiment?

We're not likely to fill in the gaps anytime in the near future. But for the present, the evidence, circumstantial though it may be, lends itself well to a very ironic and exciting possibility. Perhaps this universe, the arena for humankind's accelerating technological evolution, is itself a product of ultrahigh

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technology, designed and fabricated with the interests of life in mind. ■

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About the Author:

Richard Meisner is a researcher in Applied Mathematics at the University of Iowa, with a long-standing interest in cosmology. His technical review article, "On the Compatibility of the Universe to Complex Order: Paradigms and Speculations" appeared in the March 1986 Journal of the British Interplanetary Society."

IN TIMES TO COME

Our May issue is an "all-fiction" issue, but don't be alarmed: fact articles will be back. Meanwhile, the stories are a nicely diverse lot. Some involve characters you've met before, and others don't; but all offer something new and intriguing.

Harry Turtledove begins a three-part serial, *The Report on Bilbeis IV*. You may remember Queen Sabium, the wise and benevolent ruler whose cancer was cured, in strict violation of noninterference rules, by human visitors. They assumed the interference would have no long-range importance—but 1500 years later their successors found the queen not only still alive but firmly ensconced as a genuine, practicing goddess. Now—what happens when word of all this gets out back home, among people who oppose the very existence of the agency that did the interfering? Lying consistently is tricky business, but truth is even harder to handle. . . .

We also have a new tale of the Hlutr from Don Sakers; another of the Phuili from J. Brian Clarke, this one from the *Phuili* point of view; and a brand new world from Ian Stewart, guaranteed to possess one of the oddest ecologies you've ever seen. And Charles Sheffield offers one of the most outrageous sports stories: would you believe bicycle racing in space?

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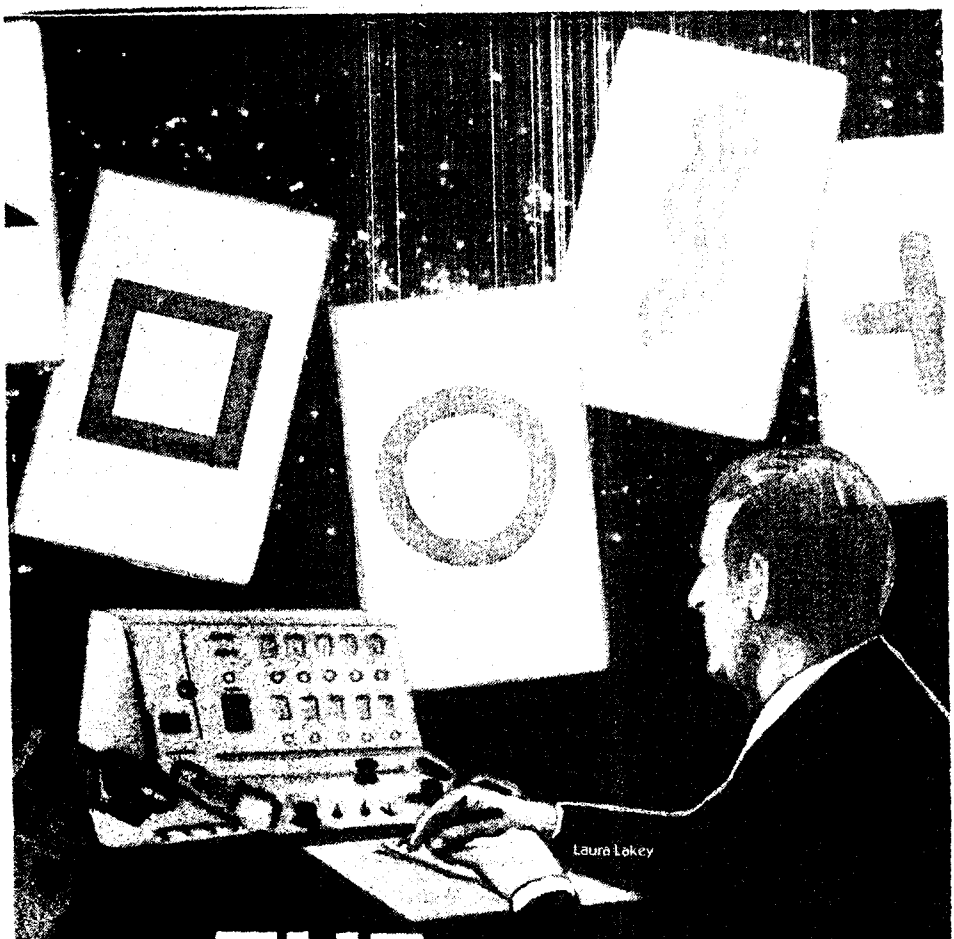

THE LESSER MAGIC

Gregory Kusnick

The difference between "magic" and "science"
is often nothing more than how much you know about it.
But what matters is not what you call
it, but what you can do with it.

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"How many people," asked Alex Houston of his audience, "think they're psychic?" He stood at the edge of the low platform, microphone in hand, the other arm upraised. "Come on, let's see some hands. How many think they're psychic, even a little bit?"

Cameras panned the semicircular auditorium, showing scattered hands.

"All right, then, how many *believe* in psychic powers? Whether or not you think you've got them."

Perhaps half the audience lifted hands this time.

Houston pivoted and strode upstage to his chair. "On my left is Thalia Sky, the well-known San Francisco psychic. On my right is Dr. Marc Bannard, writer, lecturer, Stanford University psychologist, and president of the California Society of Rationalists. Dr. Bannard, perhaps you could start by telling us just what your group stands for."

"Certainly, Alex." On the monitor Marc saw his own features click into close-up. Sweat beaded his lip, greased the bridge of his nose. *Come on*, he told himself sharply, nudging his glasses upward. *Get it together. You've done this a dozen times before.*

Yes, but never opposite— His gaze slid past Houston to the red-haired woman beyond. He swallowed, dragging his attention back to the emcee. "Basically, our aim is to encourage the critical scrutiny of paranormal claims such as those made by Ms. Sky. Note that we do *not* reject such claims out of hand, as many people charge. But we *do* feel that a healthy dose of skepticism is appropriate in examining them. As the well-known magician and rationalist James Randi is fond of saying, unusual claims require unusual proof."

"Do you yourself believe in ESP, Doctor?"

"I like to think I have an open mind about it. But in fact the scientific evidence in favor of psi is very, very poor —one might even say nonexistent."

"You sound pretty sure of yourself."

Marc nodded, picking up on the prearranged straight line. "I am. In fact—" He reached into his jacket, drew out a slip of paper and held it up for the camera. "I have here a check for $5,000, payable to anyone who can demonstrate, in my laboratory under controlled conditions, any paranormal ability whatsoever." The audience buzzed with interest. "In the ten years that I've been carrying this check," Marc went on, "out of the hundred or so alleged psychics I've tested, not one has been able to perform as advertised. Not one." He held the check up a moment longer, then returned it to his pocket.

"Ms. Sky?" Houston swiveled away from Marc. "What do you say to that?"

The red-haired woman smiled. "Suppose I offer Dr. Bannard $5,000 to prove that ESP *doesn't* exist. Can he do it?" She paused, her slate-gray eyes coming to rest on Marc. "No, he cannot."

Marc flinched away from that gaze, still shocked at seeing her again. It was the name that had fooled him. He'd heard of Thalia Sky, of course; what debunker hadn't? Yet until today he'd never met her, nor seen a picture of her—nor dreamt in his most fevered nightmares that sweet, shy Thea Welkin could grow up into such a creature.

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Thea! he cried silently, the absurdities she mouthed for Houston's audience passing by him unheard. *Thea, how did it happen?*

He thought back to their beginnings, that long-ago August. . . . *How long?* he wondered. *Eighteen years?* That last season of childhood between high school and college . . .

The Greyhound coach sighed smoothly to a halt at the crossroads. "La Cuna," the driver called out. "That's your stop, kid."

Marc sat up, flipped hair out of his eyes with a toss of the head, and stared out the window. The bus was parked opposite a weathered general store guarded by bubble-top gas pumps. Next door was a run-down antique emporium, its porch jammed with battered oak furniture. Beyond that, a few houses, followed by flat farmland fading into haze at the horizon.

Marc eyed the place incredulously. "*Here?*"

"That's right." The driver grinned into his mirror. "Don't worry; we're running a bit ahead of schedule. I expect somebody'll be along in a minute to pick you up."

"God, I hope so." Marc lugged his bag up the aisle, green fatigue jacket flung over one arm. A blast of heat hit him as he stepped down onto the packed dirt of the shoulder; a moment later he had to shield his eyes from flying grit as the bus pulled back onto the highway and drove off.

Marc watched until it vanished in the east behind a cloud of its own raising, then turned to survey the other three approaches. The land hereabouts was absolutely level, the roads laid out by Euclid himself for all Marc could tell. The wall of haze circled the horizon unbroken, save for the shimmery glint of downtown Modesto, far off to the west.

Grasping his bag, he trudged across the highway to the general store. A round-shouldered Coke machine accepted his dime in exchange for a bottle of syrupy liquid. Marc drained it quickly, sneezing as the bubbles wormed upward into his nostrils, then set the empty bottle back in the rack.

A spot of haze caught his eye, down the road to the south. Marc shielded his eyes against the declining sun, watching as the blotch resolved itself into a vehicle, a late-model station wagon sun-baked and dust-coated into premature antiquity. He waited; before long the wagon pulled up beside him and a matronly woman got out.

"Well now, look at you, Marc!" The woman pulled him into a perfunctory embrace, then reached up to tousle his hair.

Marc mustered a weak smile. "Hi, Aunt Ruth."

"Your folks get away all right?"

"Yeah, the plane left for London this morning."

"That's good. Twenty years of marriage, Lord knows they deserve a week to themselves." She glanced down. "Is that your luggage?"

He nodded.

"Well, grab it then, and let's get you home and meet everybody."

"Home" was a two-story Victorian farmhouse set in the middle of a tract of orchard about a mile south of town—if you could call half a dozen shops and residences a town. A pair of youngsters

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came slamming out of the house as Ruth pulled up by the front door. "My boys," she said fondly, getting out of the car. She swept the pair into a broad hug, tucking in shirts and smoothing hair. "This one's Ronnie," she told Marc, indicating the taller of the two, "he's seven years old, and Robbie here is five." She dimpled. "My boys."

Marc grunted an acknowledgement and followed them all inside.

Jack Welkin was seated in the living room, reading: square-shouldered, unsmiling, with an iron-gray crew cut and a bolo tie cinched up tight against his throat. He set his newspaper aside and stood to grip Marc's hand. "How do." His cool gaze lingered disapprovingly on Marc's wire-framed glasses and shoulder-length brown hair.

Marc returned the grip, saying nothing.

Meanwhile, Ruth had stepped through to the hallway. "Thea?" she called up the stairs. "Thea, come down here, please."

Thea? Marc wondered; then, *Right, Jack's daughter*. The man had been a widower when Ruth married him, according to Marc's mother's report.

"Thea!" Ruth called again, a trifle impatiently. A door clicked open somewhere out of sight.

The young woman who finally appeared was slight, fair-skinned, dressed in white shorts and a loose knit top. She slouched on one leg, bare right foot resting against her left ankle, her face half-hidden by a fall of fine orange-red hair.

"Stand up straight, dear," Ruth instructed mildly, "and say hello to your cousin Marc."

Thea complied—grudgingly, Marc thought—with a nodded, silent greeting. He smiled back uncertainly.

"Thea," Ruth went on, "why don't you go ahead and start setting up for dinner."

"Yes, ma'am," the girl murmured.

"And don't forget to lay an extra place for Marc."

A flash of irritation crossed Thea's face, vanished. "No, ma'am," she said docilely. Eyes downcast, she brushed past Marc into the kitchen.

Dinner was an awkward affair. Marc started off badly by picking up his fork just as everyone else was clasping hands and bowing heads.

"Dear Lord," Jack intoned from the head of the table. Marc put his fork down hurriedly. "Bless us, and this food which we receive from Thy bounty, in the name of Jesus Christ, Your Son. Amen."

"Amen," echoed round the table, followed by a clatter of silverware. Several pairs of eyes glanced quickly at Marc and away again.

"So, Marc," Jack began casually. "Are you a church-going man?"

Marc paused in his chewing, then swallowed. "I, uh, I guess not."

"Why's that?" The older man's eyes were on his plate, as he methodically sawed a morsel off his chunk of pot roast. "Don't believe in God?"

"Well . . . " Marc considered his answer, decided he had nothing to lose by being honest. "No sir, not the kind of God you mean."

That got him a look and a raised eyebrow. "What kind of God do you believe in, then? If you don't mind my asking."

"Maybe no kind." Marc shrugged.

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"I mean, why does there have to be a God?"

Jack meditated on that a while. "So you think when you die, you die dead and that's it."

"I didn't say that. After all, the human mind is a pretty mysterious thing. There's all kinds of evidence for stuff like reincarnation, astral projection, Kirlian auras, telepathy and other kinds of ESP—"

A subtle change in mood brought him up short. At the head of the table Jack was staring woodenly at his plate, his mouth tight; beside him Ruth mirrored his expression. The boys, Ronnie and Robbie, glanced back and forth uneasily from one parent to the other. Only Thea was looking directly at Marc, her gray eyes wide and luminous.

Later, after the dishes were cleared away, after Thea had returned to her room and Jack to his easy chair, Ruth sat Marc down at the kitchen table and explained.

"It's this way, you see," she said quietly, one eye on the stairway. "That nonsense you were talking at dinner, ESP and mind-reading and so forth." She made a deprecating gesture. "We're good Christian folks here, we don't hold with any of that silliness. But—" Ruth's voice dropped another notch. "Now I'm not one to spread gossip, you understand. But the girl's mother—well, they say she was real interested in that sort of thing. Used to talk about it all the time, or so they tell me; I never met the woman myself of course. Well, you can just *imagine* the embarrassment to her family. And *then*—" Ruth's eyebrows arched significantly. "—right in the middle of it all, she died, poor woman."

Marc shivered despite himself.

"There's them that say," Ruth went on softly, "it affected the child's mind, the trauma of it all, you see. Now I'm no psychologist, of course. But the way I see it, it can't hurt to sort of steer clear of certain subjects, you know what I'm saying?" She stabbed Marc with a sharp glance. "You keep that in mind when you're talking to her."

"Yes'm," Marc muttered. He saw again those gray eyes, beaming their hunger across the table at him. . . .

". . . even Dr. Bannard, I'll wager, wasn't always so skeptical," the woman—Thea—was saying. "Were you, Doctor?"

"Hm?" Marc started, cheeks coloring.

"In fact, something tells me you used to be quite an ardent believer in ESP."

He blinked, caught off guard. "Well, perhaps, yes; we all go through these adolescent phases—"

"Is that why you went into parapsychology?" Houston took over. "To pursue this adolescent fantasy?"

"Well—no; I mean, it's a legitimate—that is, I felt at the time it was a legitimate—"

"But you don't feel that way now."

"No, I—"

"Why not? Have you actually done any psychic research?"

"Yes, I've done a number of—"

"And what evidence for ESP did you find?"

"Nothing!" Marc said with unintended vehemence. "Not a damn thing. Every experiment was a failure."

Houston sat back, letting the silence hang for a moment. "So. A failed pro-

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gram of ESP research leads to a bitter disillusionment, turning a dedicated believer into a dedicated skeptic. Is that it, Dr. Bannard?"

Marc flushed. "My personal feelings have nothing to do with it. The plain fact of the matter is that no solid evidence for ESP exists."

"So you've said. But seeing is believing, I've always said." Cameras tracked as Houston turned to face Thea. "What about it, Ms. Sky? Do you feel up to a demonstration?"

"Well . . ." The audience shouted encouragement. "All right." She smiled disarmingly.

Houston turned again, his eye locking onto the live camera. "And we'll be back with that demonstration in just a moment, so don't go away."

When they came back on the air Houston was quick to reassure his viewers. "Hello again, folks. We're just about ready with our psychic demonstration featuring Thalia Sky. Dr. Marc Bannard is our referee; he'll back me up when I say that what you're seeing on your screens is exactly what's happening here in the studio. Dr. Bannard?"

Marc leaned forward. "Well, let's just say that I haven't seen any trickery *yet*." That got him a mild chuckle; perhaps this audience wasn't completely hopeless after all.

"Ms. Sky, in case you're wondering, is in a closed room backstage. Meanwhile Dr. Bannard has chosen ten volunteers from the audience." The camera panned down the row of people standing to one side of the stage, numbered cards pinned to their lapels. "On the table here are ten objects belonging to those ten people. So if we're all ready now, let's welcome back—Ms. Thalia Sky!"

A burst of applause greeted Thea as she returned to her seat. Marc kept his arms folded, thinking, *All this noise and she hasn't even done anything yet!*

"Perhaps you'd explain to us, Ms. Sky," said Houston, "what exactly you intend to do here."

"It's simple enough, Alex. Each object bears the psychic imprint—the vibration, if you will—of its owner. Psychometry is the art of reading and interpreting these vibrations. In this way, I should be able to match the objects up with their owners psychically."

"All right. Let's see what you can do."

"Very well." She extended a hand toward the arrayed objects, then hesitated. "I must caution everyone to say nothing until I have made my selections, you volunteers especially. Dr. Bannard will be quite upset, I'm sure, if any clues are inadvertently let slip. So please, no talking." Her hand dipped, came up with a plain gold ring. Her eyes went wide and glassy, then she closed them and held the ring between her palms. "I'm getting something . . . no talking, please . . . I'm getting—" Her eyes opened, fixed on a tall man second from the left in the row of volunteers. "Number two, I believe?"

The man looked awed. "Why, yes—"

"Please," Marc cut in, annoyed. "Ms. Sky, you yourself insisted on no feedback until the end of the test. Or is it too much to expect you to abide by your own rules?"

Thea seemed unperturbed—indeed, amused. "My apologies. It won't hap-

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pen again." She placed the ring atop a card marked 2, and closed her eyes again, a set of car keys between her hands this time. After some deliberation she announced, "Number nine."

Marc watched the procedure carefully, dividing his attention as best he could between Thea, the ten subjects, and the audience at large, alert for any hint of hand signals or other shenanigans. Frustratingly, however, he saw nothing suspicious.

On the seventh item, a small coinpurse, the routine was interrupted again. "Hmm," Thea murmured, eyes closed. "That's odd."

Marc scowled. "Ms. Sky—"

"What is it?" Houston cut him off.

"I'm getting a confused reading on this one, almost as if there were two—" She opened her eyes abruptly. "Number five, are you pregnant?"

The young, dark woman in the center of the row gasped. The audience roared. "How—how did you know?" the woman stammered. "I have only just learned a few days—" That was all that could be heard before the rising tide of applause drowned her out.

Marc stared at Thea, his protest forgotten. Her gray eyes met his, and for an instant he seemed to glimpse colored lights spinning far down in those liquid depths. . . .

No. The dark woman had to be a stooge. *(But I chose her myself—) Had* to be. *(But I saw nothing—)*

At last the ovation died down. Marc's eyes remained glued on the dark woman as Thea proceeded briskly through the remaining objects. It was all anticlimax at this point anyway, her final score of eight out of ten surprising only in its lack of perfection.

And still Marc had seen no signs of cheating.

"Well," Houston said when it was over, "that certainly was a *most* impressive demonstration. I'm sure our viewers will agree that, if seeing is believing, we've all seen more than enough!"

Thea inclined her head graciously. "You're very kind."

"Not at all." The emcee grinned slyly at Marc. "How about it, Dr. Bannard? Have you seen anything here to change your skeptical mind?"

Marc shook his head, his mouth tight. "No. This—" He was silenced by a chorus of boos.

"Wait a minute!" Houston leaped to his feet, arms outstretched. "Let him speak!" The boos died. "Dr. Bannard?"

"I was saying, this . . . *performance* . . . means nothing, scientifically. However, if Ms. Sky—or anyone else—cares to duplicate it in my laboratory, that $5,000 prize is still unclaimed."

"Ms. Sky?"

She shrugged. "Dr. Bannard is entitled to his opinion, as are we all. I leave it to your audience to judge for themselves."

Houston turned, his hands spread wide. "Well, folks? How many of you believe in ESP *now?*"

Well over three-quarters of the audience raised their hands. Marc looked away, disgusted.

"And that's about all we have time for," Houston told the camera. "So good night, and thanks for tuning in."

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* * *

Marc was halfway across the parking lot when Thea's voice overtook him.

"Marc!"

He stiffened.

"Marc, wait!"

He turned, spied her waving at him, her small frame lost within the crush of her admirers. Gray January overcast roofed city and Bay; he eyed it impatiently while she disengaged herself, speculating on the possibility of rain.

"Well?" he asked as she caught up with him. "What is it?"

"Listen, Marc, would you like to have dinner together? No big deal, just some friendly talk."

"I'm not sure we have anything to talk about," he said a bit stiffly.

She studied him closely. "So you're just going to condemn me out of hand, is that it? Without even waiting for an explanation?"

He frowned. "What is there to explain?"

"Have dinner with me and find out. How can it hurt you?"

It's hurting me already, he thought. But he kept his face impassive. "No."

"Dammit, why not?" Her eyes went blank for a moment. "Ah, I see. You're mad at being shown up in public, and hurt that it was me who did it. Well, I'm sorry about that, for what it's worth. I really am. But I would like to point out that it wasn't my idea to turn the show into a macho duel to the death. If anyone's guilty of that kind of this-town-ain't-big-enough-for-the-both-of-us attitude, it's you."

He shifted uncomfortably, eyes downcast.

"But let's forget all that for a couple of hours," she went on. "Can't we? For old times' sake. What do you say?"

"Well—"

"Good. I know this great seafood place over in Oakland; you'll love it." She glanced up at him, then dug a playful elbow into his ribs. "And for Christ's sake loosen up a bit, will you?"

"So," he said, eyeing her warily across crab cocktails. "Explain."

Thea hesitated. "Marc, can we be honest with each other?"

Can we? He chewed, swallowed. "We can try."

She nodded. "Look," she said abruptly. "I know you think I'm not what I claim to be. I just wanted to tell you that—you're right."

Marc blinked. "Oh?" he said neutrally. "You admit to being a fake?"

"I didn't say that." She stabbed vehemently at a lump of crab meat. "It's just—well, take that pregnant woman this afternoon, for instance."

Aha! "A friend of yours?"

She glanced up at him curiously. "No; what gave you that idea? I'd never laid eyes on her before in my life. But the moment I did, I knew she was pregnant. It was right there in her aura, plain as day."

"In her aura?" Marc said dubiously.

"Of course. Same thing with the psychometry. You say 'Don't tell me, don't tell me' loud enough, and they can't help but scream it in their auras. Like telling a child not to think of a hippopotamus. All the rest—the closed eyes, the handling of the object—is just window-dressing. You see?"

"Not really," he said candidly.

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"You're telling me your entire act was based on aura-reading?"

"Aura, inner face, soul mask —whatever you want to call it. Of course."

Marc froze. *Inner face . . . whirling lights . . . smell of hay and hamburgers*— Inexplicably he shivered. "Look, why are you telling me this, anyway?"

Thea's expression clouded. "I'm not sure," she admitted. "But look at it from my side. Sure, there's a lot of pretense in what I do. I accept that—I can't say I like it much, but I accept it. I mean, that's showbiz, right?" Her half-hearted smile failed to impress him, and was quickly dropped. "I just don't want you thinking it's *all* pretense."

"Isn't it?" he said softly.

"*No.*" She held his gaze for a moment, then murmured, "No. It isn't."

Abashed, Marc searched for a less sensitive subject. "How long have you been living in the Bay Area, anyway?"

"About eighteen years," she replied. "Since I left home, in fact."

Somehow he was not prepared for that answer. He put down his fork and stared at her. "*Left home?* Disappeared is more like it. Ruth and Jack were very worried about you." He flushed, dropping his eyes. "*I* was worried about you. I didn't even know for sure you were alive until this afternoon."

"Um." She joined him in inspecting the tablecloth. "What can I say? I didn't exactly want to be found."

Something clicked in Marc's brain. "Thalia Sky!"

"Right." She ventured a smile. "Not the cleverest disguise, I admit, but it was the best I could come up with at the time."

Marc leaned forward earnestly. "But Thea—I mean Thalia—" He grimaced. "Look, what do I call you, anyway?"

She shrugged. "Am I still the Thea you remember?"

"Good question." He eyed her appraisingly: the artfully styled hair, the high-fashion wardrobe, the cool professional demeanor. "That Thea would never have had the nerve to ask me to dinner."

"No," the woman conceded. "But she would have wanted to."

There was a short silence while a waiter came and set their main courses before them.

"You could have told *me* where you were," Marc rebuked her softly, out of the memory of old pain. "You could have written me or something."

"*I* could have—" She looked stunned. "What about *you*?"

"Me?" He frowned, uncomprehending. "How? You ran away."

"No, I mean—" She sighed. "Never mind. We lost touch and that's all there is."

Marc gave a dissatisfied grunt. "All right, then, what about later? You must have followed my career, just as I've followed yours. You knew who I was. Why didn't you get in touch?"

"Marc—" She hesitated. "Put yourself in my place. As you said, I'd followed your career, I knew your reputation." Her gray eyes studied him. "Frankly, I thought you'd hate me for what I am."

Hate you? he wanted to protest. *I couldn't*— But that knowing gaze brought him up short, and he dropped his eyes away, saying nothing.

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He recalled their first conversation, a day or two after his arrival. He was in his room, unpacking, when the sound of her voice came drifting in through his open window: a high, sweet song, something from Joni Mitchell, he thought. It cut off abruptly as he opened the window wide and leaned out.

She was sitting on the porch roof, her back against the house, a large pad of paper propped up on her knees. In her hand was a red pencil; a box of assorted colors sat beside her on the shingles.

"Hi there," he ventured.

Thea ignored him, shading in an area on her sketch.

He looked out at the horizon, the endless flat earth neatly gridded out in a mosaic of orchards and dairy pastureland. "Nice view."

"What if it is?"

"Just making conversation," he said sullenly.

"Yeah, well, don't." She put aside her red pencil, exchanging it for a green one.

Marc craned his neck for a view of her sketch: a landscape, akin to the one spread out beneath them, yet different, its trees drawn in somber greens and browns beneath an eerie yellow sky. "Hey, that's pretty good."

She set down her pencil and sighed, staring into the distance. "Is this your idea of a good time? Making fun of me?"

He blinked. "I'm not making fun of you."

"Sure. I know what you're thinking. You hate me, you think I'm weird."

"I don't hate you!" he protested, baffled.

"Oh, yeah?" She turned to look him full in the face, her eyes glinting in the sun. Abruptly the fire went out of her. "Then you're weird," she muttered, looking away again.

That did it. "Look," Marc said tightly. "Maybe you can fool your friends with this brat routine—"

"I don't have any friends." Defiantly: "I don't need any."

"Huh?" He frowned. "Everybody needs a friend."

"Well, I don't." She turned her back on him, huddling against the wall of the house. "So why don't you just go away and leave me alone, all right?"

Marc didn't move. "Thea—"

"*Go away!*" she screamed.

He flinched. "I'm sorry," he said defensively. "Jeez." And drew his head back inside, but not before seeing her shoulders shake, and the gleam of moisture sheening her cheek.

He recalled how, after days of wheedling, he had finally been permitted to see her portfolio of sketches. There was one in particular that struck him: a sort of homespun madonna in shawl and apron, rocking an infant before a blazing hearth, an odd blue-white nimbus suffusing her features. The portrait was rich with detail, from the floral print of the mother's dress to the pitted brickwork of the fireplace.

"That's neat," Marc said. "I like that one."

Thea studied his face anxiously. "You're not kidding. You really like it."

"Sure I do. Just one question, though." He pointed. "Why's her face all lit up like that?"

"Not her face," Thea corrected.

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"Her *inner* face." She watched Marc intently, almost hungrily. "You know."

Marc blinked. "Inner face? What's that, some kind of artistic concept?"

She scowled, clearly disappointed. "No."

"What then?" Her manner made him feel stupid for asking.

"Nothing." She took the folio away from him. "Just forget it."

He recalled a lazy afternoon spent swimming in the broad irrigation canal along the farm's south border. He recalled vividly the way she looked reclining against the concrete bank, eyes closed, her body sleek in a one-piece swimsuit the exact sweet-potato hue of her hair. White highlights traced her contours, and Marc fancied he could see the twin bumps of her nipples tenting the fabric of her suit. In all the world, surely there had never been a creature so beautiful.

Her eyes opened then and saw his gaze upon her. Blushing, she sat up, hugging her knees to her chest. "Hi."

"Hi." Marc paddled over to beach himself beside her. "Nice day for a swim."

"Mm," Thea agreed, looking out across the water.

Marc studied her profile, heart pounding. "Nice company, too," he dared at last.

She glanced sideways at him, cheek brushing one knee. A shy smile softened her features. "Thanks." She bit her lip, then added, "You're not such bad company either."

Marc ducked his head, grinning crazily. "That's the nicest thing you said all week."

Abruptly Thea's smile vanished. She faced forward again, chin resting on crossed forearms. "You're leaving soon, aren't you?"

He nodded, equally serious. "Coupla days. Gotta get ready to go away to college."

"Oh." She drew her legs up tighter against her body. "Far away?"

"East coast." Then, with a touch of pride: "Harvard."

"You got into *Harvard?*" Her eyes grew round. "You must be some kind of genius or something."

"Well," he boasted, impressed by the impression he'd made, "I *was* at the top of my class in high school."

"Bullshit."

"*Huh?*"

"Second from the top, maybe," she said, eyeing him keenly. "Not top."

"Well, I *would* have been top if I hadn't blown that biology exam," he replied sulkily. Then: "Wait a minute. How'd you know that?"

Her eyes went blank, gray concrete walls shutting him out. "Know what?"

"That I was only second in my class."

She gave an elaborate shrug. "Just a guess."

He felt a sudden chill. *I know what you're thinking.* "Thea—"

"Look, I have to go. It's almost suppertime and I've got chores to do." She grabbed her towel and stood.

"Thea, wait!"

But she did not respond. He had a last momentary glimpse of her rump as she scrambled up the bank, then she disappeared over the top and was gone.

"Well," she said to him, on the side-

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walk outside the restaurant, "I suppose I ought to be going. It's getting late, and I've got a million things to do tomorrow—" Their eyes met briefly. "Good night, Marc. It was good seeing you again." She turned—

"Thea, wait!" he was astonished to hear himself say.

She paused, turned back. "Yes?" A brisk wind off the Bay tugged at her hair, stood the collar of her raincoat on edge beneath her chin.

Marc looked at her, mouth dry, pulse drumming in his ears. He felt suddenly foolish, knowing what had to come next. It was inevitable, ordained from the moment he laid eyes on her this afternoon, even their earlier antagonism merely a necessary part of the dance. Yet now that the moment had arrived he found himself unable to utter the words.

She watched him, her special percipience open to his distress. She moved closer. "Marc," she said softly, "would you like to come home with me?" More softly yet: "Please?"

He swallowed, nodded. "All right."

She stood before him, naked, hair unpinned and falling loose around her shoulders. His eyes traveled the length of her, his fingers reached to touch her hair; then he opened his arms and enfolded her, planting kisses on forehead, neck, shoulders. She smiled, and, taking his hand, led him to the bed.

He looked into her eyes, and she touched him. He reached, and she knelt astride him, one breast dangling near his mouth; he kissed it, nibbling gently at the nipple. Then, clasping her rump, he turned his face upward, and she slid slowly down his body till their lips met.

There were no words to their duet, and no false notes either. He had only to think his wish for her to act on it; as their intensity built, desire and response became one, his fancies fulfilled almost before he recognized them. And when he was done with passivity she sensed that too, rolling beneath him, her slitted eyes locked on his, while he devoted himself in turn to her pleasure.

An eternity later he lay back, cradling her, searching for words and breath to convey his astonishment. "Jesus," he said at last. "That was fabulous." He aimed a crooked half-smile at the ceiling. "If I didn't know better I'd almost think you were reading my mind."

Her body, stretched full-length against him, became suddenly and subtly aloof. "That's not funny, Marc."

"No," he said, abashed. "You're right. I'm sorry; I don't know what made me say it."

"I do," she murmured sadly.

He flinched. "What?"

She levered herself up on one elbow. "Marc, why can't you bring yourself to trust me? Forget Thalia Sky; I took her off with the makeup." She picked up his hand and clapped it against her ribs. "This is *me*, Thea Welkin. Doesn't that count for something?"

Oh, lord, Marc sighed. *What am I doing here?* "Look," he said reasonably, withdrawing his hand. "I'm convinced that you believe you've got some kind of supernatural power, if that's what you're asking."

"I'm deluding myself, is that it?" Her voice grew bitter. "Just a crazy girl

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grown up to be a crazy woman. Thanks a lot!"

"Now wait a minute, I didn't say—"

"You didn't have to say! I know what you're thinking!" She leaned over him, breasts swaying, pupils wide and focused somewhere—beyond. "*Insecure,*" she recited, her voice a monotone. "*Out of touch, classic case . . . what? what's she—? . . . strange eyes . . . a trick, it's a trick, she's not really . . . those eyes, spooky, see right inside—*"

Marc snarled, thrust her away, struggling upward, shouting, "Is that why you brought me here? To seduce me with your flummery?"

She gaped at him from where he'd flung her. "Oh, *Jesus*, Marc!" Her head sank into the sheets, her shoulders quaked with hurt.

Marc felt himself reddening. He reached out to touch her, winced as she shrugged his hand away. "Thea, I'm sorry," he said. "Really. That was a rotten thing to say, I know." He shook his head. "But you can't expect me to believe in telepathy or auras or whatever just like that, without proof."

Her voice was thick with tears. "You were ready enough to believe eighteen years ago."

He smiled, a slight sad smile behind her back. "Time passes. I'm afraid I'm no longer the young man I used to be." Then, seriously, "Don't you see, Thea, it's not a question of trust. Of *course* I trust you." And, surprisingly, he meant it. "But trust just isn't the same thing as proof."

"Not to you," she agreed bitterly. "You and your rigorous goddamned laboratory-type proof."

"I'm sorry you feel that way. But it's the only kind of proof that means anything to me."

She was silent a long time. Then, unexpectedly, she rolled over to face him, wiping moisture from her cheeks. "Okay," she said heavily.

"Huh?" Marc was caught off guard. "Okay what?"

"Okay, you can have your proof. I accept your famous challenge. Bring on your Rhine cards, your randomizers, your Faraday cages. Do whatever it takes to convince yourself I'm real."

Marc eyed her uneasily. "Thea . . . I don't think—"

"What? Your challenge is open to all comers, isn't it?"

"Ye-es. I just—" His voice dropped. "I just never imagined you'd be one of them."

"Well, I *am* one of them."

He shook his head. "You don't understand. It's not my beliefs that are at risk here. A rigorous scientific test could destroy everything you think you know about yourself. It could turn your whole life upside-down."

"Or yours."

"Or mine," he conceded. "But all the smart money's on yours."

"So?" She seemed unperturbed. "I'm thirty-five years old, Marc. If I *am* just kidding myself, don't you think it's time I found out about it?"

"Well, yes, but—"

"But what?"

He looked away. "I just don't want to see you hurt."

She smiled, shiny-cheeked, touching a fingertip to his face. "Thanks. But I'm willing to risk it if you are."

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"Jesus," Marc muttered. *How do I get myself into these things?*

"Marc?"

"Okay!" he burst out. "Okay, okay, okay. You win. We'll do the test."

Marc sat nervously at his desk in the great hall, surrounded by the faceless shadows of his fellow students. What to do? Here it was, exam week already, and he hadn't studied! Worse: he'd skipped every class since the term began eighteen years ago, and had only the vaguest notion of what the course was about. What to do, what to do? All around him rose the sibilant scratching of pencils, of knowledge poured forth eagerly onto paper. In the entire hall only Marc was idle.

"Bannard!"

Terrified, he leaped to his feet. "Yes-sir!" The hall shrank away and he found himself face to face with a trio of stern professors. Medved, Gruber, Edelman: his doctoral committee, glaring dubiously down at him with smooth girlish features, their flowing red hair arrayed about them like judicial wigs.

The middle one—Gruber—stabbed an ominous finger at the typewritten document before him. "Explain what you mean by this mizma gorp wuggle zlotch."

Marc gaped. The words meant nothing to him; he racked his brains, but could not remember even the bare concept of his thesis.

"Well?" Edelman demanded, her gray eyes boring into him. "Let's have an answer. And don't try to fool us; we know what you're thinking!"

Indeed. The wires trailing from Marc's face shook with his trembling, rattling against the framework of the largest polygraph apparatus he had ever seen. It towered over him, a massive rack of recorders and amplifiers crowned with an enormous red gong like an oversized fire alarm.

He licked his lips. "I'm sorry, I didn't hear—"

"*Bullshit!*" the committee shrieked in unison. Simultaneously the bell went off, an ear-splitting jangle that catapulted Marc from his pillow, his pajamas tangled and sweaty.

He groped about on his nightstand, finally managed to shut the damned clock off. Then he just sat for a moment, collecting his wits. *The test*, he realized abruptly. *It's today!*

Thea met him at his office, a flat, brown-wrapped package beneath her arm. "For you," she said, holding it out.

Marc took it, eyeing her quizzically, then closed the office door behind her. "Thanks." He waved her to a chair while he leaned against the desk. The brown paper came away to reveal a watercolor portrait of a young man, long-haired and bespectacled, done in muted reds and browns. A delicate tracery of blue-white lines covered the youth's forehead and cheeks like a voodoo mask.

He looked up at her. "Thanks," he said again, sincerely. "This is really good."

She smiled. "Thank *you*."

"Ah . . ." Marc studied the portrait again, grinning sheepishly. "Okay, dumb question. Who is it? John Lennon?"

She cocked her head. "Boy, you've

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really blocked that whole era, haven't you?"

"Hm?" He frowned. "What era?"

"That's *you*, Marc. The way you used to look. I did it from memory, a day or two after you left."

"Me?" He stared at the picture. "I'll be damned."

A rap sounded on the closed door. Marc stepped across the tiny cubicle and opened it. "Ah, John. Come in."

The man who entered was hawk-featured, silver-maned, burly. "Good morning, Marc."

"Thea, this is Dr. Verrine, my department head. John, Thea—er, Thalia Sky. The psychic I'll be testing today."

"Ah." Verrine bowed slightly in Thea's direction. "How do you do?"

"Well, thank you."

"What's up, John?" Marc asked him, laying the portrait aside.

Verrine's eyes followed it curiously, then returned to Marc's face. "May I speak with you a moment?"

"Sure." To Thea: "Excuse us, will you?"

"Of course."

Marc followed Verrine into the hallway and closed the door.

"Rather striking technique on that portrait," Verrine remarked casually. "Use of color and so forth. Very interesting."

Marc nodded. "Yes, it's Thea's trademark, so to speak."

"Thea?"

"Ms. Sky, I mean." Marc flushed a bit. "I, uh, used to know her as Thea Welkin."

Verrine's brow lifted, his lips pursed. "Marc," he began slowly. "You realize of course I have the greatest confidence in you."

Uh-oh, Marc thought. "Of course."

"Nevertheless . . ." He fixed Marc with a piercing gaze. "Be careful. Stand firm. Don't be fooled."

Don't try to fool us; we know what you're thinking! Marc swallowed. "I won't be."

"Good. I *do* trust you, you know. I just felt that it needed to be said"

Marc nodded. "I understand."

"Very well, then." He clapped Marc heartily on the shoulder. "Carry on."

Before they proceeded, however, there was a written agreement to sign.

"Agreement?" Thea's brow creased. "What kind of agreement?"

Marc pulled a document from his desk drawer and passed it over. "No big deal. It says that in accepting the challenge, you understand the nature of the experiment, you agree that it's a valid test of your powers, you accept certain numerical standards of success and failure, and so forth. Just a formality, really."

"I see," she said carefully, looking it over. "You'll excuse me, but I didn't realize this was that formal an affair."

He spread his hands. "You can still change your mind—"

"No." She reached for a pen. "I'm going through with this."

The test itself took place in a narrow observation booth Marc had reserved for the purpose. The booth was faced with one-way glass: though Thea could see through to the sender's station in the next room, the senders themselves would see only their own reflections. Marc had sought even greater isolation, by using

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closed-circuit TV to convey the sender's image to Thea, but she had laughingly vetoed that plan:

"I can't read auras off a TV screen, Marc. It just doesn't work that way. Auras are—mystical, spiritual in nature. Not physical *things* at all." She grimaced. "I know that sounds like airheaded nonsense, but it's true. TV cameras just don't pick them up."

So they compromised on the booth.

Already cramped, the tiny space was further reduced by Marc's arsenal of equipment. Video cameras and recorders lined the rear wall; a computer terminal and chair stood to one side, with a second, slave display backed up against the glass observation window. A third display waited in the next room, a single chair pulled up behind it, both of them screened from Thea's view by black cardboard flats.

Marc ushered Thea to a seat before the second console. "Is that comfortable?"

She nodded. "Adequate."

"Good." He adjusted two cameras to peer over her shoulders, then went around the tiny room activating equipment, finally taking a seat behind his own console. "Let's review the routine. A pair of simple pictures will be displayed side by side on your screen, each one designed to convey a particular mood: happiness, anger, sorrow, whatever. Simultaneously, the computer will randomly pick one of those pictures to show the sender. If you think you know which one, push the button under your left or right hand as appropriate; you'll have five seconds to make your choice before the next pair is displayed."

"Suppose I can't tell?"

"You can pass any given pair by pushing neither button. Remember, though, that you must choose at least fifty percent of the time, and of those choices at least sixty percent must be correct for the test to count as a success. As we agreed."

"Right, I remember."

He typed a string of commands into the computer. "Ready?"

A flash of pink tongue-tip appeared between her lips. "I . . . I guess so." Her body stiffened slightly in the chair.

All at once the magnitude of her courage came home to him, humbling him. What, after all, had *he* to lose from this test, which she would almost certainly fail?

Almost? a tiny voice mocked him. He paid it no heed.

"All right, then," he said briskly, dimming the booth lights. He touched an intercom control. "Sender number one, please."

A door opened at the far end of the sender's room and a young woman entered. Seated, her face was just visible above the screening cardboard flats.

Marc looked at Thea. "The first twenty-five are for practice, okay? Here we go." He typed a final command and sat back.

Instantly his screen went dark. To minimize unconscious cuing, Marc would remain ignorant of the actual images shown Thea and the sender. His role at this point was simply to keep his eyes open for signs of hanky-panky.

He saw nothing untoward during the practice run. Thea's face was blank, zombielike in the eerie green glow of the computer display. Her fingers tensed alternately in slow syncopation—left,

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right, pass, left, pass, pass, left, right—entering her choices into the machine for later evaluation. There would be no scoring, no feedback of any kind, until the run was completed.

After a couple of minutes Marc's screen returned to life. "How was that?" he asked Thea. "Any problems with the procedure so far?"

"No . . ." she replied hesitantly. "The procedure seems all right—"

"But?"

She flashed a weak smile. "Let's say it's a bit more . . . *challenging* than I expected."

Marc punched out an instruction on his keyboard. "Well, you're doing all right so far. Eight out of fourteen right, with eleven passes. Not bad for a start."

"Thanks." But she looked worried.

He reset the score. "Now for the real thing. One hundred trials, followed by a five-minute rest break. Then we bring in a new sender for the next hundred, and so on for a total of a thousand trials."

"Got it."

"Okay." He touched the intercom button once more. "Thank you, number one. Can we have the next sender, please?"

Verrine rejoined them in Marc's office at noon.

"Well," he said cheerily. "How did our subject score?"

Marc switched on his desk terminal. "We're just about to find out." He glanced sideways at Thea, seated next to him. "You ready?" he murmured.

"I suppose so," she acknowledged glumly. "Though I'll be surprised if I did very well. It was all so . . . so *abstract*—"

Marc felt a pang of compassion, mixed with—what? Regret? *Disappointment?* the tiny voice suggested. *You used to be quite an ardent believer . . .*

Marc stifled the thought, turned to his keyboard and typed a command—then stared at the resulting readout.

"Well, Marc?" Verrine prompted.

A strange giddiness swept over Marc. He felt a crazy impulse to leap up and embrace Thea, restraining himself only with difficulty. Slowly, as though balanced on a knife edge, he swiveled away from the terminal.

"Four hundred and two hits out of six hundred forty-four guesses," he announced shakily. "Sixty-two point four percent correct."

Verrine's face froze.

Slowly Thea's frown erased itself. "You mean—I did it? I passed the test?"

"No," Verrine spoke up suddenly. "No. There's some mistake."

"*Mistake?*" Thea flared. "Marc, tell him. Did I pass or didn't I?"

Marc hesitated, acutely aware of two sets of eyes upon him. "Well," he temporized, "John does have a point. We do have to take into account the possibility of some unforeseen procedural error."

She stared at him. "I don't believe this. You're trying to weasel out of it! Two and a half hours I spent staring at your damned cartoons. Sixty-two point whatever percent correct. And now you tell me it doesn't mean a thing!"

"Ms. Welkin," Verrine said with exaggerated patience. "Or Sky, or however it is you style yourself. We are not

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trying to 'weasel out' of anything. Dr. Bannard has every intention of upholding his end of the agreement, as soon as the experiment is complete and all the data fully analyzed."

"Uh huh," she said dubiously. "And how long will that take?"

The elder scientist shrugged. "Some weeks, I should think. Marc?"

"Sounds right."

"I see." Thea looked from one to the other of them, disgusted. "In other words, you need time to concoct some theory to explain it all away."

Marc's control cracked. "Look, what do you want us to do? Call up the *National Enquirer?* Even you should be able to see that's exactly the wrong approach to take." He lifted his hands. "Okay, so it *appears* that you did something today that, *at the moment,* we can't fully explain. Congratulations. But that's all you're going to get from us right now, because to say any more than that would be irresponsible. If you knew anything at all about science you'd *know* that."

Thea threw up her hands. "Right. That ends *that* conversation. In which case—" She gathered her things and stood. "—I don't see much point in hanging around. Good day, gentlemen."

January fled before a flurry of winter storms. Toward the middle of February the weather broke, warming, but Marc hardly noticed, immersed in the analysis of Thea's test data. Valentine's Day came and went with no word from Thea, and no solution to the puzzle in sight.

"Damnation!" He slapped the *Pause* button and peered closely at the video monitor, pencil at the ready. "I don't see it. I just don't see it." He flipped the recorder's control over to *Rewind.* "One more time—"

"Marc?" Verrine's head and shoulders appeared, reflected, in the dark glass of Marc's office window. "Am I interrupting?"

Marc threw down his pencil in disgust. "No, come on in, John."

Verrine entered and took a seat. "I was just leaving for the night when I saw your light on. How is it going, by the way?"

"It's not, I'm afraid." Marc stopped the recorder and sighed. "Look, check my logic on this, will you? Assuming a fair test—which it was—there's only three ways Thea could have got the kind of score she did. One: she could have cheated—"

Verrine nodded. "A distinct possibility, to my way of thinking."

Marc grimaced. "I'm not sure I can agree. I've been in this business a long time, John. I know a con artist when I see one. Or in this case, when I *don't* see one."

"That's a rather subjective evaluation."

"Granted. But I also know a thing or two about deception, and how to guard against it, and I saw no sign of it in this case. Anyway, look at the pattern of her scores." He shuffled a paper out of the mound on his desk and passed it over. "Normal distribution, with a spread of maybe ten percentage points from best sender to worst. Now if she had some kind of signal system operating, you'd expect one or two of those senders to stand out, with the rest down at chance level. But that's not what we

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see here. So unless she somehow got to *all* of them—"

"Yes, I see your point."

"Okay. The second way she could have done it is by picking up on some kind of subliminal cues."

"Ah." Verrine's eyes lit up. "Facial expression, perhaps?"

"If so, they're so subtle neither I nor anybody else can identify them. I ran a control study using these tapes and the original picture pairs past every expert I could think of—psychologists, psychiatrists, a couple of magicians I know—plus a dozen or so student volunteers. Not one of them scored any better than chance."

Verrine frowned. "May I see these tapes?"

"Be my guest." Marc punched a button; a sallow young man appeared on the monitor, eyes downcast. "Take sender number five, for instance." The tape rolled; the young man blinked, blinked again, his face otherwise impassive. "The original stoneface, right? I mean, I'd really hate to be across a poker table from this guy. Yet Thea actually got her highest score off this sender."

"Hmm." Verrine stared at the screen. "Those eye-blinks—"

Marc laughed. "I'm way ahead of you, John. I timed the pattern of those blinks and ran correlations against everything I could think of: his pictures, Thea's pictures, even the left/right handedness of her guesses."

"And?"

"Zilch. Zero information content. The blinks are just blinks."

"Some other signal, then."

"What other signal? The camera sees everything she sees."

Verrine was silent a moment, his eyes on the chart in his hand. "This variation in test scores, plus-or-minus five percentage points you said. How do you account for that?"

"I don't." Marc shrugged. "It doesn't correlate with anything I've been able to measure, and given the run length we're working with here, you'd expect that much variation from chance alone."

"I see." The older man returned his gaze to Marc. "Let's suppose for the moment that you're right, then. Eliminate cheating and subliminal cuing; that leaves—?"

"Real ESP," said Marc.

Verrine snorted. "Oh." He made a gesture of dismissal.

Marc stared out the window at the gathering night, seeing little but his own reflection and the portrait of his younger self propped against the glass. "You know," he mused, "for a long time we skeptics have been saying we'll believe it when we see it. But I wonder. If that one real psychic does finally come along, how will we react? Just how conclusive must the evidence be? At what point does healthy, rational skepticism turn into unhealthy and irrational prejudice?"

"Marc," Verrine said slowly. "You're not saying you believe this woman's claims?"

Marc hesitated. "No," he said at last, turning away from the window. "No, I'm not saying that."

"I should hope not." Verrine fitted his palms together carefully. "Well, obviously we must examine the first two possibilities, cheating and cuing, more

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closely." He glanced up at Marc. "You seem to have some sort of understanding with the subject; is there any hope of testing her again, under more stringent controls?"

Marc sighed. "I doubt it. She thinks she won the first round, so why should she risk a second?" He bit his lip, then went on quietly, "Frankly, she's got a point. By the rules we both agreed to, she's earned that prize money."

"You're convinced, then, that there are no further insights to be extracted from these data?"

Marc shrugged. "You can check my analysis if you like—in fact, I'd appreciate it. But yes, I think I've squeezed out just about everything."

Verrine's frown deepened into a rictus of distaste. "In that case," he said heavily, "I suppose you're obliged to honor your bargain."

"I suppose so," Marc echoed reluctantly. "But . . . Jesus, John! The press will have a field day!"

The older man shrugged unhappily. "They'll have a field day if you don't honor it."

Marc waited through three or four rings, rehearsing what he'd say to her: *Thea, you'll be interested to know*— No, make that *I thought you should know*—

"Hello?" A man's voice.

Marc's mind went blank. "Uh . . . hello. I'm looking for Thea—I mean, uh, Thalia Sky? Is she there?"

"Who's calling, please?"

"Tell her it's Marc Bannard."

"The debunker?" The man's voice was suspicious. "What do you want?"

That irritated Marc. "Just tell her, okay?" He heard muffled murmurings, then a rustle as the phone changed hands.

"Yes, Marc?" Thea's voice said curiously.

"Who was that guy?"

"My agent. We're discussing a five-city tour he's putting together for me. Why?"

"I—" Marc stopped, embarrassed. "No reason, I guess. Sorry."

She grunted. "So what's up? Don't tell me you've actually come to some kind of a decision about me."

"As a matter of fact I have."

"Really?" A note of caution entered her voice. "What kind of a decision?"

He sighed. "I concede. You win the $5,000."

Pause. "That's it?" she said dubiously.

"What do you mean, 'that's it'? Don't you want the money?"

"I don't care about the damned money!" He heard her draw breath, release it. "I care about you, about what you believe."

"Uh—" He swallowed. "I don't know what to believe."

"Oh, for Christ's sake, Marc!"

"Thea, please. Do you think this is easy for me?"

"I don't know. Is it?" Then, grudgingly, "No, I suppose not. Dammit, I hate communicating this way. When can I see you?"

Marc blinked. "What for?"

There was an awkward silence. "Well, I mean if you'd rather not—"

"No, no." His voice dropped a note. "I—I'd like to see you."

"Well, what about this weekend? I was planning on driving out to my place

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in the country on Saturday anyway; I can stop and pick you up on the way. All right?"

Marc swallowed, his mouth suddenly dry. "All right."

"So when do you break the news?" Thea guided the car up a ramp and onto the freeway. "You *are* planning on making it public, aren't you?"

"Yes," Marc conceded. "There's a meeting of the Psychological Association in a couple of months; we thought we'd make the announcement then."

"A couple of months?" Thea feigned shock. "Rather precipitate, don't you think?"

"Hey, look, I don't make the schedules. There's a long lead time for these things; that's just the way they work."

"I see." She was silent a moment. "Well, what about me? Do I have to wait months to learn the truth?"

"Truth?" Marc frowned. "What do you mean, truth? I told you the truth on the phone the other night."

"Did you?" She glanced across at him briefly, then shrugged. "Have it your way."

Marc stared out the window at the endless agricultural lands crawling past. "Of course," he said meditatively, "the delay does have its advantages."

She laughed. "I thought it might. For instance?"

"For instance, it gives us the chance to bolster our conclusions with additional research."

It took her a moment to digest that. Then, "Wait a minute," she said. "You're talking about getting me back into that booth for another round, aren't you? Well, forget it."

"Look, Thea," he said earnestly. "I really think this is in everyone's best interests. You're convinced of the paranormality of your power, aren't you?"

"Yes," she said slowly.

"Well, then, what have you got to lose?"

"What have I got to gain?" she countered. "I mean, suppose I succeed again. You'll spend another three or four weeks analyzing data before admitting you're stumped, and then we'll be right back where we are now."

"Not necessarily."

"Oh, yes. I know you, Marc. One more demonstration is not going to change your mind. Or two more, or ten. You're just too stubborn to be convinced that way."

"What do you suggest, then?" he replied testily. "Do we just agree to disagree, and do nothing? How will that solve anything between us?"

"Oh, I don't intend to do nothing."

Marc raised an eyebrow. "Then—?"

"You'll see," she told him, grinning diabolically.

Marc almost didn't recognize the crossroads. The old general store was gone, replaced by a 24-hour gas station. The surrounding orchards had largely given way to office complexes, shopping malls, swatches of tract housing. A bronze plaque in the sidewalk marked the grave of the original La Cuna, swallowed up now in creeping suburbia.

Thea turned the car south at the intersection, away from the developed corridor. A mile or so later she turned east again, and Marc caught his breath. The orchards were lovely, frosted with pastel pink blossoms, the old Victorian

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rearing up stately above them, a giant's castle on a cloud. Low drifts of fallen petals lined the driveway on both sides, swirling as the car breezed past.

"Your place in the country."

She nodded. "What's left of it. You see what's happening back there." She aimed a thumb over her shoulder. "Well, after Father died, Ruth started selling off parcels of land to pay bills. I happened to hear about it through a client of mine—you'd be surprised at some of my connections—and managed to save a piece by outbidding the other developers."

"And you still operate it as a working farm?"

"Not me; I've got a tenant who works it for me. He gets the use of the land, at a rent low enough to guarantee him a good profit. I get the house, and visiting privileges in the orchards, and a convenient tax write-off at the end of the year. It works out."

She stopped the car and got out. Marc grabbed his overnight bag, followed her up the front steps and into the house—

—And stepped back eighteen years into the past. *Thea, come down here, please.* Orange-red hair, smoldering gray eyes . . . *Say hello to your cousin Marc—*

The real Thea watched him closely. "Brings back memories, doesn't it?"

"That it does," he agreed.

Her lips turned up minutely. "Good."

Evening marred the illusion of a past reentered. The crystal constellations of memory were cloaked now in the nebulous sky-glow to the west. Modesto itself was a glimmering marine creature on the horizon, sending forth luminescent tentacles to encircle the quiet darkness of the orchards; soon—in a few years at most—that embrace would be complete, the farm engulfed within the body of the urban organism.

Marc turned his gaze away from that prospect, to its reflection in the eyes of the woman beside him. "Why did you bring me here?" he asked.

A cool breeze washed over the porch, raised a whispering wave on the fragrant sea of the orchards. Thea's voice came softly, a murmur against the greater murmur. "You know why."

"I don't," he protested.

"Not you." She moved closer, eyes steady on his, long hair blowing free in the wind. "*You.* The other Marc, the one I used to know. You're in there somewhere, I'm sure of it."

Marc shivered. "You're talking nonsense."

"Oh, no," she said softly. Her eyes widened, shifted—came to a focus somewhere behind his forehead. An alien thrill swept through him.

Inner face . . . colored lights, spinning, whirling . . .

"Ah," she breathed. "There you are—"

He tensed. Emotions roiled within him, leaching away the thin ice of his rationality. He chose his words with care, fearing any misstep that might plunge him into that maelstrom. "Thea. Please. I'm—"

"Don't be." She took his hand, her eyes never leaving his face. *Deep eyes . . . gray eyes . . . whirling lights . . .*

"Dizzy . . ." she murmured, "spinning—"

Whirling . . .

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"Carnival lights—"

They walked together through a gyrating galaxy of neon—pink, blue, emerald, sunshine yellow—past constellations called Octopus, Tilt-a-Whirl, Crack-the-Whip. The air was vibrant with the scents of cotton candy and livestock, the shouted pitches of carnival barkers.

"Step on up, sonny, win your girl a teddy bear. Only ten cents a throw, three for twenty-five, one ball in the basket does it. Step on up and show your pretty lady what you can do."

My girl. Goosebumps shivered Marc's flesh as he traded shy smiles with Thea, savoring the taste of the man's words. *My pretty lady . . .*

And pretty she was—nay, radiant—in a puffy-sleeved cotton print dress, her hair held back off her face by a green satin ribbon. He'd even told her so, earlier that evening, as the family gathered in front of the farmhouse for the ten-mile ride to Turlock and the county fairgrounds.

"Wow," he'd said, his own washed-out bells and embroidered work shirt seeming suddenly drab. "You look great."

Thea blushed, glancing furtively at her stepmother, whose attention was occupied with keeping the boys in check. "Thanks," she whispered back. "It's one of Mama's old dresses."

"Well, I like it," he told her. "You ought to dress like that more often." And turned to find Ruth's chill gaze witheringly upon him.

But that was earlier. Ruth's influence did not extend here. Here he could do and say whatever pleased him, and what pleased him now was—

"You hungry?" Thea asked.

He grinned. "Took the words right out of my mouth."

They found an Elks Club hamburger stand, fat sizzling patties with ketchup and relish for 25¢ each, washed down with 10¢ Cokes. Afterward they wandered through the exhibit halls, past Vegematics and hearing-aid salesmen, salt-water taffy pullers and funky automatic corn-dog dispensers. There was a homemakers' display of sweaters, shirts, and quilts; a cornucopia of lush produce, five-pound zucchinis and fifty-pound watermelons; a mineralogical exhibit, strange crystalline lumps of rock glowing eerily blue and green under black light illumination, plus one large chunk of quartz encrusted about with nuggets of real gold.

And when he tired of these she led him back out to the midway, the neon jungle, the swirl of lights and blare of sound. They rode the Ferris wheel, where, paused at the top, she pointed out La Cuna, a dim smudge of light away to the north. Marc leaned close to sight along her arm, cheek brushing her ear, his nostrils open to the scent of her. . . .

Getting off, they passed a group of young people about their own age, waiting in line to board. There were four of them, the two girls blond and pretty, the boys close-cropped, muscular, dressed in crisp chinos and knit jerseys.

"Hello, Thea," one of the girls said coyly, casting a sly look at Marc.

Marc smiled back uncertainly, glancing sideways at Thea, who mumbled

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something unintelligible and kept walking. Marc hurried to catch up.

"Friends of yours?"

"No." Her expression was stony.

Behind him Marc heard a murmured remark, a sudden burst of laughter. From the corner of his eye he saw Thea flinch.

"Hey, what's the matter?" he asked her.

"Nothing," she mumbled, eyes downcast. Her ears glowed scarlet.

Suddenly Marc understood. His lips compressed, his fingers curled; he started to turn back—

"Don't look!" Thea hissed as a new round of giggles erupted. "Just—just ignore them." She looked ready to perish from mortification.

"Shit," he muttered helplessly, falling in beside her again. "What do they want to laugh at us for, anyway?"

"Not us," she said. "Me. They think I'm . . . weird." Her voice sank to a whisper. "Crazy."

"Well, they don't know what they're talking about. I think you're just fine."

Her eyes thanked him. "You're about the only one."

"Ah, come on. Why should anyone think you're crazy?"

"Because—" She looked away, her face suddenly closed. "Just because."

Damn. A week's work invested on dismantling that barrier, and now there it was again, solid as ever. If only there was some way to get permanently past it, to make contact with the real Thea, the inner—

Click. "Because of the inner face?"

She glared at him. "What do you know about it?"

"Nothing," he confessed. "But I'd like to learn."

"Really?" Her expression softened a bit. "You won't laugh?"

"I promise."

"Well—"

He reached out and took her hand, twining his fingers gently through hers. "Come on," he said. "Let's go someplace where we can talk."

". . . kind of like a ghostly mask, with all different—I guess you'd call 'em *colors* in it, and the colors change according to what's going on in your head."

Marc frowned, shifting his butt against the scratchy bale of straw. "You mean like red means one thing, and green means something else?"

Thea hesitated. "No. I mean, yes, something like that, but not that kind of color, not red and green and so forth. Different colors."

"Different how?"

"Like . . ." She frowned. "This sounds stupid, but it's like they're colors but they're not colors. I mean, you couldn't go out and buy a pencil or crayon that color. I know 'cause I tried."

Marc grunted. "And you say everybody's got one of these ghost masks, hovering in front of them all the time? Even in the daylight?"

"Oh, sure. If anything they're stronger in the daylight. But not in front." She was emphatic on that point. "Inside. That's why it's the *inner* face. It's like you look and see the face, and then you look harder and see the inner face. The face beneath the face."

"And what do you see on this inner face?"

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"All kinds of things. All your emotions and feelings, all the things you try to hide with your outer face. It all shows up on your inner face."

"All of it?" he said numbly. "The lies, the mindfucks, all the shit people carry around in their heads, is all right there for you to see?"

She nodded.

"Jesus." Marc shivered. "No wonder you hate everybody."

"I *don't* hate—" Her eyes and voice both lowered. "—everybody."

Marc felt a thrill of pleasure at that. "How many people know about this?" he asked her. "Your family?"

Thea shook her head. "Mama knew. She knew before anybody, before I knew myself, even. I mean, you just don't think about that kind of thing when you're a baby." Her eyes grew wistful. "I remember being with her when I was little, just *being*, no talking, you know what I mean? It was like she didn't *have* to talk to me. Just looking at her I could tell what she was thinking, what she was feeling. How . . . how much she loved me." A tear escaped to go coursing down her cheek; she shrugged, wiping it away. "I thought that was the way it was supposed to be."

Marc felt a pang of sympathy. "What about your father?"

"*Papa?*" She barked a quick *Ha!* —but there was no laughter in it. "He doesn't believe in the power. Thinks it's un-Christian. Satanic. Once when I was little he and Mama had a big fight about it." Thea's eyes clouded, looking inward. "I mean like a *big* fight; I don't think they could have known I was watching. *Witch!* Papa kept calling her, and *Devil-woman*, and shouting a lot of Scriptury-sounding stuff. Like he blamed *her* for everything that's wrong with *me*."

"There's nothing wrong with you!" Marc protested.

But she wasn't hearing him. "I was really scared. Mama didn't say anything, just sat there listening to him yell. But it was hurting her, I knew. I could see all the colors going out of her inner face, almost like she was dying right before my eyes, just fading and fading, until finally there was only this pale sort of ghost-face left." Thea blinked, peering past Marc into the night. "And then—I think it was only about a week or so later—all of sudden she really was dead."

Marc swallowed. "How?" he asked simply.

"She—" Thea frowned, her eyes distant. "They said it was an accident. I remember I was in bed, asleep I think. Suddenly there was this noise outside, a big bang; I didn't know what it was, but it woke me up. I heard Papa go running out to the barn, and I got scared there in the dark all by myself so I followed him out. He was standing there in the barn door, and there was all this blood and Mama lying there in the middle of it and he was saying 'Sweet Jesus' and 'Lord forgive her' and all stuff like that. I guess I must have squeaked or something because he turned around real fast and grabbed me, hustled me back into the house. When the sheriff's deputy came, Papa told him Mama'd heard some dogs out in the chicken-yard and gone outside to scare them away and the gun just went off by accident. I remember thinking that was funny be-

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cause I sure didn't hear any dogs. But the deputy believed him, I guess. And then later, after everyone was gone, I saw Papa burning a piece of Mama's note paper in the fireplace."

She paused, breathing deeply. "It was a long time before I figured out that she'd killed herself. And it was a long time after *that* that I got up the nerve to ask Papa what was in the note." She shuddered, her arms half-raised in front of her. "All of a sudden he got crazy. *Real* crazy. He started shouting at me, calling me all kinds of names, just like that time with Mama—"

She broke off, her eyes round and glassy. Marc reached out to touch her shoulder—"Thea?"—and she flinched away from him, cringing as if from a blow. "Thea, are you all right?"

A convulsive shudder wracked her. Marc grabbed her arms and she blinked up at him as at a stranger. Then her face cleared and she dropped her eyes. "Sorry. I—I never told anyone that before. I didn't expect it to be so—" She shook her head. "Sorry."

"It's okay." He released her, dropping his hands into his lap. "I understand."

"Oh, Marc!" she said suddenly, surprising him with her urgency. "Don't go away tomorrow, all right?" She grabbed his hands between hers as if to restrain him by force. "You can stay a while longer, can't you?"

"Well—" He eyed her in dismay. "It'd be nice. But Mom and Dad are coming back tomorrow, and there's only a couple of weeks left to get ready for college—"

Stone by stone, he watched the walls go up as he spoke. "Look," he implored, "I'll write to you, okay? That's a promise."

"Sure," she said dully, not looking at him. Her hands withdrew into her own lap to pick idly at a frayed seam of her mother's dress.

"I will!" he vowed. "Look into my inner face if you don't believe me. Go on, look!"

Reluctantly she turned her face upward. Marc leaned close to her, whispering, "I'm not going to forget about you, Thea."

Hope bloomed slowly as she opened herself up to him. The revolving lights of the midway made of her eyes twin pools aswim with glimmering animalcules. Marc gazed at them, marveling. Was it really no more than a week since his first glimpse into those fluid depths?

"Seems like forever, doesn't it?" she murmured.

His pulse jumped. *It's true—you can really—*

She nodded. "It's true. I can."

"Oh, Thea—"

"No," she said, smiling. "Let me." Her eyes probed deeply into him, her tongue flashed briefly between her teeth. "*Amazing*," she whispered, "*magical, wonderful . . . eyes, lights, whirling, see right inside me, inner face, two minds same thought . . . like in songs, two minds hearts beating as one beating beating minds hearts happiness love—*"

She stopped, staring, the echo of the word reverberating tangibly between them—then he swept her into his embrace as his own internal voice resumed, *love oh love Thea Thea love you Thea love you love you—*

A giggle, a gasp, a guffaw from behind them. "Whee-oo!"

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"Looks like Thea's got herself a hot one!"

Marc whirled, furious, to face the quartet from the Ferris wheel.

"Ooo, he looks mad."

"Crazy."

"Must be crazy, to like *her*."

Thea paled, folding into herself, each word a blow.

"Hey, Thea! Seen any good ghosts lately?"

That did it. "Idiots!" Marc shouted, rising. "Don't you know a miracle when you see one?"

"Oh, it's a miracle, is it?" one of the boys mocked. "This guy must think he's Jesus or something."

"What's that make her?" his girlfriend responded. "The Virgin Mary?"

More laughter.

"*It's not a joke!*" Marc screamed at them. The foursome flinched from his fury, began to edge away uneasily. "It's real! It's real, God—"

"—dammit!" he choked, his eyes watering so that the orchards and the woman before him wavered and blurred in his vision. "It *was* real! Real magic! And then you disappeared and the magic was gone and I went looking for it, searching, researching—"

He tumbled forward into her arms, tears slicking his cheeks as she rocked him, crooning, "It's all right, it's all right, I'm back, I'm here—"

"—But it was *gone!*" he cried. "The magic was in you and *you took it away!* Why did you do that, Thea?"

"I—" He barely heard her hesitation. "Well, I'm back now, it's all right, I've brought the magic back."

She used it on him again, that magic, in the guest bedroom where he'd stayed so long ago. Only this time, when he embraced her, it was with full awareness of her special sensitivity. And still she dazzled him; indeed, his own willingness to be dazzled made their union that much more complete. At the peak he could all but hear her thoughts himself as she echoed back to him his own passionate intensity.

Afterward, she lay against him, her naked rump nestled in his groin. *Thea, my love*, he marveled silently, brushing his lips against her neck, *how could I ever have doubted you?* She stirred a bit, drowsily, as if in answer, and he felt a thrill of pleasure where her flesh touched his.

Laying a hand on her arm, he asked again, gently, "Why did you go away, Thea?"

She shrugged, inscrutable. "Why did you?"

Marc blinked. "I had to, you know that."

"Well, so did I."

He waited.

Sighing, she twisted in place to stare up at the ceiling. "You know, for a while I was really proud of the way you stood up to those kids at the Fair; it was something I'd wanted so much to do but never could. Then, for a while, I really wished you hadn't done it. Not that I'm blaming you, you understand. But you see, folks around here had always *suspected* I was crazy. After word of that incident got around, they *knew* it."

Marc was stunned. "Thea, I'm sorry—I never thought—"

She reached over to squeeze his hand.

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"It's all right, Marc, I'm not blaming you."

"Was it very bad?" he asked, subdued.

"Well—yes, it was. When you left it was like going back to prison after a week's freedom. Not that the cell was any different—but now I knew what lay outside it." She paused, gave him a lopsided grin. "Hey, cheer up. That was a compliment."

Weakly, he returned the smile. "Thanks. I just wish I could have helped."

Her own smile inverted suddenly; she rolled away from him again. "So do I. For weeks I kept expecting to hear from you. When you didn't write, I was crushed. I couldn't believe it; I thought it must be my fault, that I must have misunderstood you somehow."

Marc stared at her back, shocked speechless.

"After a couple of months," she went on, oblivious, "I actually started to doubt that our friendship had even happened, or that it meant what I had taken it to mean. I began to think I'd fantasized the whole thing. For a while there I guess I really was crazy, in a way." Her voice was low. "I don't think I've ever quite forgiven you for that, Marc.

"One day," she said, "when I was especially depressed, I happened to catch a look at myself in the bathroom mirror. I saw my own aura—except it didn't look like mine. It was . . . weird. Frightening. Like . . . I don't know what." She paused. "That's not true. I do know. It was the death-aura. I knew because I'd seen it before, on my mother, in the week before she shot herself."

She sighed, turning back to him at last. "And that's when I knew I had to get away, had to—" She broke off, frowning. "What is it, Marc? What's wrong?"

Marc swallowed, breathing slowly. "Thea," he managed to say, "I *did* write to you. Dozens of times, starting just a few days after I left. You never answered my letters."

"I never got them," she said, perplexed.

They stared at each other for a moment; then—

"*Ruth!*" they shouted in unison.

"Rragh!" Marc snarled, his fingers tensed into claws. "God *damn* that woman and her pop-psych theories! When I think of all the pain she's caused you—"

"Caused *us*, Marc. All your years of bitterness—" She touched his face. "But it's done; there's no changing it now. Let's forget it, and look toward the future."

The future . . . Marc shivered. "I don't know if I'm ready for that quite yet."

She shrugged, snuggling against him. "Then don't worry about it. There's plenty of time."

"Marc," the taped message ran, "this is John Verrine calling at quarter past seven on Sunday evening. I've got something very interesting to show you; give me a call when you get in, or meet me at the Bio labs, room 308, first thing Monday morning. Oh, and bring Ms. Sky if you can; this concerns her too."

Marc stared at Thea. "The *Bio* labs?"

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She shrugged. "That's what he said."

And so, at 9:00 Monday morning, to the Bio labs they went. Room 308 proved to be a cramped laboratory cubicle on the top floor.

"Ah, Marc, Ms. Sky," Verrine greeted them effusively. "Glad you could make it. Come in, come in."

Marc did so, glancing about the apparatus-cluttered cubicle. "What's up, John?"

Verrine grinned slyly. "Have a look over here, in the incubator."

Marc stooped to peer into the box. Inside was a glass culture plate half-filled with nutrient gel; a vague circular discoloration marked the surface of the gel. "What is it?"

"*Aspergillus sudophilus,*" Verrine replied. "A species of skin fungus related, if I recall correctly, to the yeasts. It's quite widespread, though basically harmless; I suppose that's why it hasn't drawn a lot of attention. I had to search through quite a few journals to find a description of it."

"And what's so special about it that you dragged us up here to see it?"

"Ah," said Verrine. "Watch." He activated a video monitor, then aimed a jury-rigged camera arrangement at the plate. The screen blurred. "One moment," Verrine apologized, fiddling with the focus. "I'm afraid there's a bit of difficulty with chromatic aberration in the optics. Not designed for these wavelengths, you know— Ah. There we are."

On screen, the culture plate jumped into sharp relief, the circular smear within it glowing with an eerie blue light.

"It seems to be some kind of fluorescent effect," Verrine explained, "rather like a Day-Glo pigment. Lord knows what purpose it serves. Perhaps none; perhaps it's merely a side-effect of some routine biochemical activity. But apparently it's not at all uncommon for microbes of this general type to show some kind of fluorescence, at one wavelength or another. This one seems to absorb energy in the near ultraviolet, at about 3000 angstroms, and re-emit it rather broadly around 3500 angstroms —so close to the visible, in fact, that ordinary window glass is largely transparent to it. The exact spectrum—"

"John," Marc interrupted. "I'm sure this is all quite fascinating, but what does it have to do with us?"

Verrine gave him an odd smile. "Do you know where this culture came from?"

Marc shrugged. "It's ubiquitous, you said."

"And so it is. This particular sample, however, came from the forehead of sender number five—'the original stoneface,' as you once called him. All of your senders have it in one degree or another; number five was merely the most plentiful source."

He gestured toward the incubator. "The temperature in the box right now is thirty-five degrees Celsius: typical human skin temperature. If I change the temperature—" He reached out and adjusted a knob; on the monitor the microbial glow became marginally greener. "—the spectrum of luminescence changes. We've also found it to be remarkably sensitive to changes in acidity, moisture, applied electric field, and a number of other factors. A kind of natural polygraph, if you will. The jour-

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nal articles I found made no mention of that aspect of it. But then who'd think to look, eh?"

Marc frowned. "Hold up a moment. You're telling me this stuff colonizes people's *faces?* And that it gives off this changing spectrum of—what'd you say? Ultraviolet light?"

"Just so." Verrine's expression was smug. "Perhaps you'd care to step over here, in front of the camera?"

"Marc," Thea spoke up suddenly. "I don't like this."

Neither did Marc. But he did as Verrine requested, his eyes glued to the monitor. For a moment he saw nothing but a confused blur; then the focus cleared and his own face emerged, surreal in false-color, a ghostly mask of light wreathing his features.

Thea gasped. "But—no! It's not possible, TV cameras don't pick up auras . . ."

"This one does, Ms. Sky," Verrine said silkily.

Marc barely heard him, watching in shock the image of his own distress: blood draining perceptibly from his face, the blue-white webwork of vessels paling to a ghoulish green. . . .

". . . your answer, Marc." Verrine's voice faded back in. "No ESP. Nothing supernatural. Just ordinary ultraviolet light."

"No." Marc dragged his eyes away from the monitor. "I don't believe it. You can't mean *this* is what Thea sees."

Verrine eyed Marc critically, his lips pursed. "Ms. Sky, would you hand me that folder, please?"

"Excuse—" She seemed befuddled. "Folder?"

"Over there," Verrine instructed. "The dark blue one." There were several folders on the counter, Marc saw, in various shades of blue, gray, and black.

Thea hesitated, then passed over one of the gray ones.

"Thank you." Verrine turned to Marc, waved the folder in his face. "You see? Change just one DNA codon, one protein, one retinal pigment—and where we see blue, she sees ultraviolet. That portrait in your office was the key: all low-frequency colors, reds and greens and yellows. No blue in the picture at all, except for the facial aura—"

"Marc," Thea cut in. "Marc, what is it? What's he saying?"

"Just a minute!" Marc squeezed his eyes shut, pressed his hands to his temples. *Ultraviolet vision?* he thought wildly. *Fluorescent skin fungi? It's crazy . . .* "Look, John," he said, opening his eyes again. "This is a bit much for me to take in all at once. I'll talk to you later about it, okay?"

Verrine spread his hands. "By all means."

"Thanks." Marc turned to Thea, found he could not meet her eyes. "Come on," he said somewhat listlessly. "Let's get out of here."

"The thing is," he said, flopping down on the manicured expanse of lawn, "John's theory does have a certain crazy logic to it."

Thea knelt beside him. "Are you saying you believe him?" Her eyes fixed on Marc, widened, shifted focus—

Oh my God, he thought hollowly. *Chromatic aberration! The lenses aren't*

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designed to handle it; it takes a special effort to focus the UV image.

Thea's face fell. "It's true, then."

Marc hesitated, then nodded. "I suppose it is." *No ESP. No magic.* His shoulders sagged. *Jesus, what have I done to myself?*

"You know," he said suddenly, "when I was a kid, I sent away once for a pair of those X-ray specs you see advertised in the backs of comic books."

Thea looked away. "Marc, please."

"*Ha!*" The sound hurt his throat. "Didn't work worth a damn. I guess I always was a sucker for that sort of thing."

"At least you still have your career," she said bitterly.

"As what? A debunker?" He snorted. "We found out how sincere I was about *that*, didn't we?"

Thea bowed her head. "Then I guess we're both washed up."

"Both?" he echoed. "How so?"

She looked startled. "Am I misunderstanding something? I had the impression I'd just been exposed as a fake."

"Oh." He shrugged carelessly. "Since when does that matter, in your business?"

"It matters to me," she said irritably. "Christ, Marc, you know me better than that."

Do I? he wondered. "Yeah, well, don't go feeling too sorry for yourself. I know a dozen clinicians who'd give their right arms to do what you can do."

Thea blinked, sat back, her expression thoughtful.

Grunting, Marc turned his gaze skyward. Clumps of ragged cloud blew in on the chill west wind, like bits of soiled Kleenex. *Another storm coming.*

"So what happens now?" she asked him. "The press conference, the announcement—"

"Hell, I don't know. Verrine'll want to go ahead with it, I guess, get his dibs in on this UV thing."

"What do you want?"

He frowned. He thought of a farmhouse in the middle of nowhere, of pale girl-flesh shimmering beneath sunlit waters, of pink cheeks, puffy sleeves, and green satin ribbons. He sighed. "I'm afraid what I want doesn't exist."

"Doesn't it?" Her voice was low, urgent. "Two minds, two hearts—there's a kind of magic in that, isn't there?"

He looked into her eyes then: gray eyes, freakish eyes. Kaleidoscope eyes. He saw the miracle in action, as she assessed the parameters of his emotion, and found himself wondering what it would be like to experience that rapport daily.

Smiling, she moved closer. "Don't you think it's worth finding out?"■

●Reality provides us with facts so romantic that imagination itself could add nothing to them.

Jules Verne

submitted by G. Harry Stine

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The Alternate View

STRINGS AND THINGS

John G. Cramer

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This Alternate View column is about *cosmic strings*, strange massive objects that may have formed shortly after the Big Bang when the energy saturated space of the early universe was being replaced by the more normal space in which we now live. (Warning: *cosmic* strings should not be confused with the sub-microscopic *supersymmetric* strings discussed last year in Margaret Silbar's science fact article "SUPERstrings" [*Analog*, February, 1986]; these share the name "string" but are quite different.) If they exist at all, cosmic strings will be infinitesimally small in cross section but very long, perhaps forming loops that encircle an entire galaxy. And they will be quite massive, producing strong and very odd gravity fields. Cosmic strings can be loosely described as "seams" or "cracks" in space or as linear quantum black holes. They are long closed-loop tangles in the fabric of space itself. They are (or at least may be) geometrical imperfections in topology produced as the universe was unfolded out of the Big Bang. Cosmic strings are now of great interest because they may be the "seeds" that caused the formation of galaxies. Moreover, they may also resolve at least part of the "dark matter problem," which was discussed in my Alternate View column "The Dark Side of the Force of Gravity" in the February, 1985 issue of *Analog*.

Since the dark matter problem was featured in that column, I'll just remind you that there are good reasons to think that most of the mass in the universe, between 30 and 300 times more than the normal "visible" matter in stars, is in some mysterious "dark matter" form. The 2/85 AV column discussed the idea that hypothetical particles called "axions" might be responsible for the extra mass of the universe. This now seems unlikely. Since 1985 an amazing new picture of the large-scale structure of the universe has emerged from careful measurement of the recession velocities of a large number of very faint galaxies. These studies show that when viewed on a sufficiently large distance scale the universe resembles a sponge. There are large holes or voids hundreds of mega light years across that are almost empty of stars and galaxies. These enormous holes are bounded and connected by planes and filaments dense with galactic clusters.

This emerging picture of a hole-riddled universe has caused axions to lose favor with cosmologists as a dark-matter candidate. Axions are slow-moving "cold" particles that cannot be responsible for the large-scale hole structures. What is needed is a model of dark matter that provides a mechanism for forming *both* the large holes and the finer-grained clumping of matter into galaxies and galactic clusters. A favored scenario explaining both structures suggests that fast-moving "hot" dark matter parti-

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cles, perhaps massive neutrinos, are responsible for the large hole structure while cosmic strings are responsible for the granularity of galaxies and galactic clusters within this overall sponge-like structure. This latter idea is reinforced by a recent analysis of the space distribution of stars within nearby galaxies using the new mathematical technique of *fractal analysis*. This shows that the "fractal dimensionality" of the galaxies analyzed is about 1.2, strongly suggesting a one-dimensional string as the underlying object producing galactic structure.

What *are* these cosmic strings? One good analogy is that strings are like the lines formed in iron and magnetic materials when several magnetic domain-boundaries meet. We can also make the geometrical analogy that lines are to points as cosmic strings are to magnetic monopoles. Both strings and monopoles are imperfections in space itself that may have occurred in the initial phases of the Big Bang, when normal space was precipitated from the energy saturated Higgs space of the primeval universe. Strings are line-defects in space and monopoles are point-defects.

Both monopoles and strings should be extremely massive. Suppose you could somehow snip out a section of cosmic string that was one meter in length. The mass of this meter length of string may be as large as 1×10^{25} kilograms. This is a truly enormous mass, about 1.6 times the mass of the entire earth. When we consider that a hypothetical cosmic string that may have caused the formation of our galaxy would probably have a length of thousands of light years, it becomes clear that a single such cosmic string could indeed be the dark matter responsible for a large part of the mass of our galaxy.

While a string should show normal Newtonian inverse square law gravity at distances much larger than its loop-size, general relativity tells us that the close-up gravity field of a string will be quite weird. Despite the string's enormous mass, it will exert *no gravitational attraction* on objects close to it. It has a peculiar "conical" gravity field that exerts no force on a nearby mass. Instead space is distorted into a sort of conical shape, rather as if a wedge of space starting at the string had been snipped out and the cut edges joined together. If you travel in a closed circular path enclosing a length of cosmic string and measure the total angle through which you traveled, you will find that you come back to your starting point before you have traveled a full 360°. In other words, the string distorts the very geometry of space so that there are less than 360° in a circle when the circle includes a string within its loop.

This geometry distortion can produce dramatic effects when the string is moving. If a string cuts through a star, for example, all matter in the wake of the string's passage will be highly compressed by the angle-squeeze effect. The material of the star in this situation will be compressed to enormous density. Then it will rebound and literally explode, releasing a large amount of energy supplied by a slight reduction in the kinetic energy of the string. It is possible that some of the novas reported by astronomers are the result of such string-star collisions. If all galaxies con-

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tain such strings and if this mechanism for producing novas accounts for a significant fraction of all novas, then there should be a "nova-prone" zone in galaxies in the vicinity of the string. This may provide one observational means of testing the string hypothesis.

A less violent effect of a moving string is that it causes light traveling in its wake to receive a sort of geometrical push. This "blue-shifts" the light, increasing the frequency and energy of its photons. Such a blue shift of the primordial 3° K microwaves from the Big Bang should be quite apparent in microwave measurements presently planned and in progress. This can be used to set limits on the mass and motion combinations of strings within our galaxy.

A related gravitational effect of a string passing across the line of sight of more distant objects is that it should produce double images of those objects. The conical space-warp of the string acts as a sort of prism, deflecting light so that objects behind the string are seen *twice*, with images both above and below the line of the string. There was a recent report that such a double image had been found. The May 6, 1986 issue of the New York *Times* trumpeted the headline "Powerful Source of Gravity Detected Deep in the Universe." The article concerned a report in the journal *Nature* published by a group of astronomers at Princeton University of observation of a double quasar image. Such double quasars have been seen before and are explained as the gravity-lensing effects of galaxies between the object and the observer. But the Princeton double quasar showed images separated by 156 arc seconds, a separation more than 20 times larger than that of any previously observed double quasar. Such a huge separation could only be the result of an extremely massive galaxy or a cosmic string. For a week or so there was great excitement in the astrophysics community.

It is unfortunate that perhaps half the time when there is a new and exciting result in science it is new and exciting because it is *incorrect*. That's what happened in this case. Other astronomers found in examining the Princeton "double quasar" image over a wider range of light wavelengths that the double quasar really seemed to be two unrelated quasars that happened to have similar brightness and wavelength spectrum characteristics and to be fairly close in the sky. Before this was realized, however, a number of science-oriented magazines (fortunately not including our own *Analog)* had run major articles on the amazing double quasar and the super-massive object it revealed. But let's press forward and refrain from drawing moral lessons from the misfortunes of others.

Despite this non-discovery, it is possible that strings *have* already been observed. Another property that cosmic strings should have, if they exist, is that they should be excellent superconductors. This means that if a string spans two regions of the galaxy that are at different electrical potentials, perhaps because of effects of the galactic magnetic field, a large current will begin to flow in the string. The growth of such a current should produce intense and detectable microwave radiation. It may be significant that recent microwave images of the center of our galaxy have

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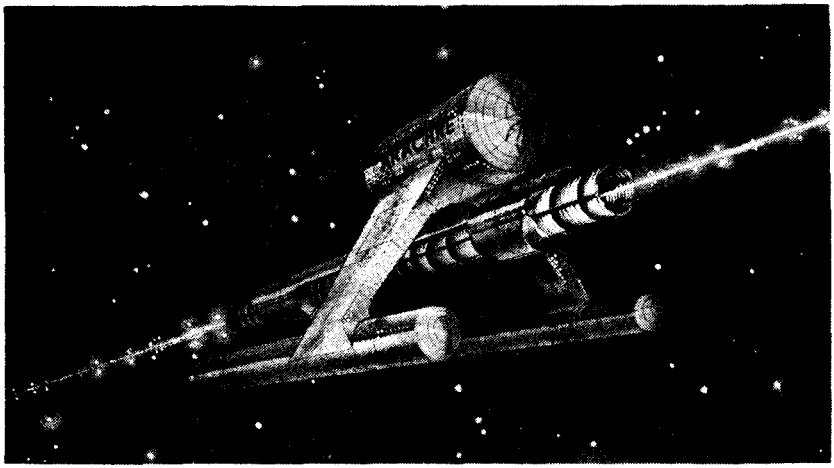

Illustration by William Warren Jr. 1987

shown threadlike structures that seem to be sources of microwaves. This had led to speculation that these "threads" are cosmic strings.

This column appears in a science fiction magazine. So let's assume for the moment that the cosmic strings are real and consider their science fiction implications. The Japanese are presently devoting a large development effort to propelling railroad cars and ships with *linear induction motors*, devices which propel vehicles along by "paddling" with a changing magnetic field against magnetic materials embedded in a rail line or against the conductivity of salt water. We can work the same trick with a space vehicle using a string in place of the rail line or the water. Suppose we travel in space to the nearest point where a cosmic string passes and surround it with an array of magnet coils attached to our space ship. We can induce traveling magnetic pulses in the coils and the superconducting string will respond with opposing magnetic fields which will move us along.

This process requires energy, of course, but it does not require that we shoot reaction mass out the back, rocket-style, to gain momentum. This is a "reactionless" drive, for the huge mass of the string provides a convenient base to push against in order to gain momentum and kinetic energy. And the energy should be recoverable. It should be possible to push against the string until we are half-way to our desired destination along the string, accumulating velocity by "investing" stored energy

(continued on page 178)

FOOTNOTE:

In 1982 the August to Mid-September issues of *Analog* featured a three-part serial, "Rails Across the Galaxy" by Andrew Offut and Richard Lyon, based on a notion that bears some similarity to the railroad idea discussed here. The scheme in the novel was to use six super-intense laser beams, three in each direction, spanning the galaxy as an energy supply system for propelling star ships by light pressure. A cosmic string ringing the galaxy could be the natural equivalent of this propulsion system.

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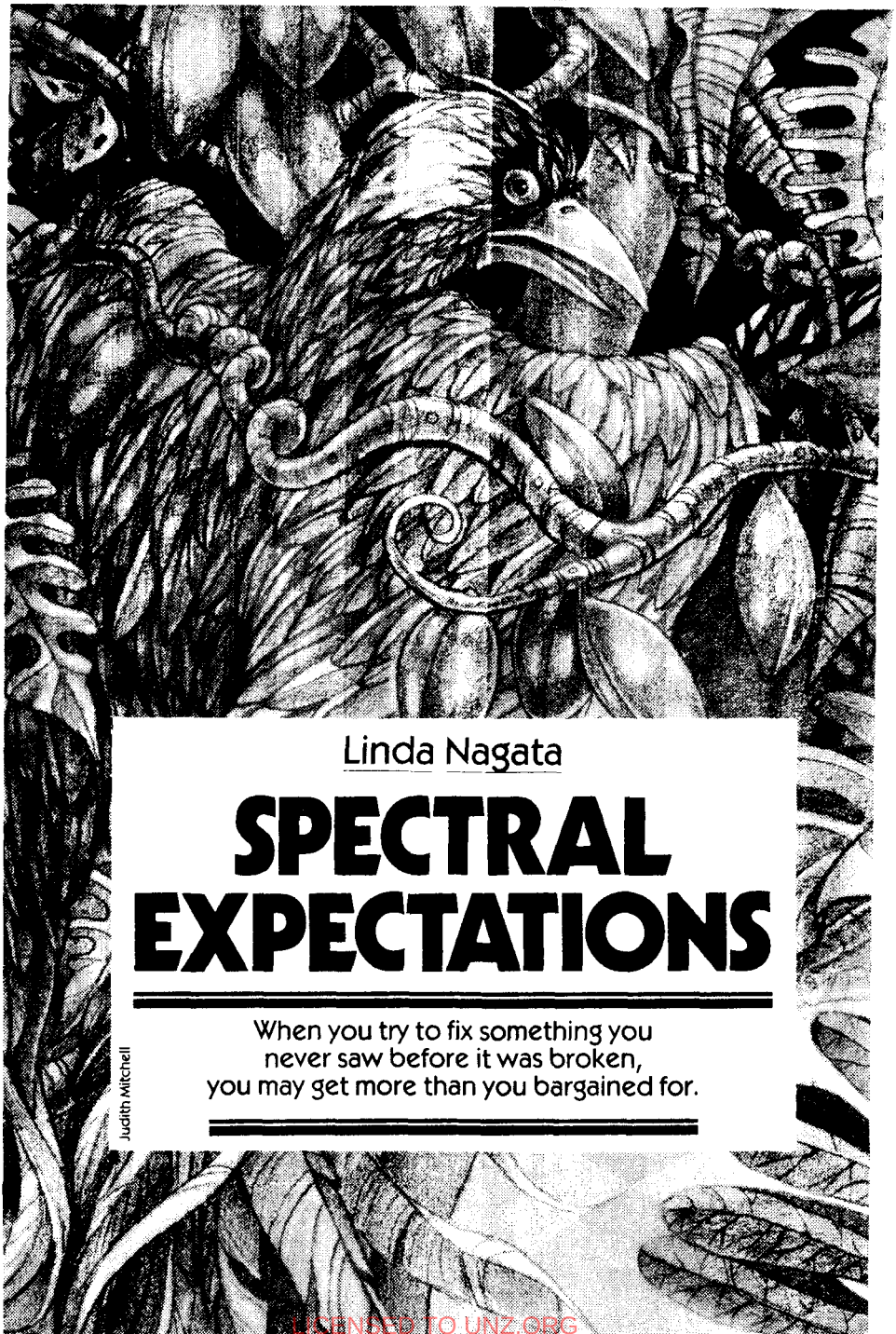

Linda Nagata

SPECTRAL EXPECTATIONS

When you try to fix something you never saw before it was broken, you may get more than you bargained for.

Judith Mitchell

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It was raining when I landed on Maui, a heavy downpour that pounded the runway and pulled the terminal lights into long, watery reflections. I disembarked, threading my way past bewildered tourists and lei-bearing, professional greeters dressed in authentic polynesiana.

A sleepy clerk at the rent-a-car booth examined my Hertz card. "Mr. Kyle Fisher," he mumbled, then turned to his terminal and called up my reservation.

Not much had changed at Kahului airport since I'd last come through, some years back—but elsewhere . . . the industrialized world was in flower. The controversy over lunar mining rights had been settled with minimal loss of life and the ensuing land rush had fostered a global economic spiral-up. The first generation of factory stations in lunar and Earth orbits were already producing more of their own kind. Multibillion dollar investments were common, because returns came back on the same scale. Projects that would have seemed frivolous two decades ago were suddenly being drawn up in detailed plan—a sure sign of good times. Everybody had a thumb in the pie. Even me. I'd won a position as sector boss on K.B.—my own sweet slice of glory.

"How long's this storm supposed to last?" I asked.

"Two days."

Wonderful. I only had two days of leave left.

For three weeks I'd been moving around the country, sort of a peregrination I guess, saying goodbye to old friends and family, some of whom I didn't expect to see again. K.B.—Kasorsky Biological Station—was in assembly over Venus and I was bound there, scheduled for a shuttle flight on the 31st—the first leg of a very long journey. I wouldn't be home for at least seven years.

"Are you here for business or on vacation, sir?" the clerk asked, remembering to be friendly.

"Visiting an old friend."

"Ah."

Derek and I had been college buddies, and I'd spent more than a few vacations at his folks' place, trying to lose some of the tensions built up during the University of Hawaii's long semesters. Graduate school and a few years of honest employment had passed since I'd last visited the Chun farm. I hoped that not too much had changed.

"Hitchhiking's illegal and you have to wear your seatbelt," the clerk warned. "And no smoking in the car. Have a great vacation."

"I will."

The rain had slacked off to a drizzle by the time I turned onto an unpaved road bordering a prosperous macadamia nut plantation. As I downshifted and leaned on the accelerator, the car skidded in the mud, back wheels fishtailing while the headlights swept crazily across stark, regimented rows of trees. The road climbed for a quarter mile, then split, one branch diving down to cross a gully, the other, narrower, steering a level course. I took that one, forded a long puddle, and pulled up in front of a farm house now nearly eighty years old.

"Shit, Derek."

The house was dark. Derek had warned me his folks would be out, but I'd thought he at least would be there. Leaving the car lights on, I switched off

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the engine and made a dash for the covered lanai. An old shepard dog was lying on a mat by the front door. He got up on stiff limbs and walked over to sniff me, his rheumy eyes friendly.

"Hey, Hoku. You still alive?"

The front door was unlocked so I stuck my head in and yelled. No answer. I found the light switch and hit it. Dim yellow porch lights threw their shadows across the cement floor. I went back to the car to retrieve my bag and turn off the headlights. Derek would show up eventually.

The farm—more of a hobby than a business—belonged to all of the Chun family, though the day-to-day work was done by Derek's folks. Mostly they grew taro, a semi-aquatic plant that thrives in flooded terraces called *lo'i*. Taro had been a staple in ancient Hawaii; prepared as poi, it was still a popular food.

I went through the house, but found no one; returned to the lanai to wait.

Some kind of pet bird was roosting on a perch set up in a sheltered corner of the lanai. A bit of sennit bound its leg to the wood. It ruffled its feathers and made an odd, throaty sound as I approached. The bird was beautiful —somewhat larger than a mockingbird and black, with a long tail and tufts of yellow feathers on its wings, on the sides of its head, and at the base of its tail. Its dark brown eyes swept across me, a calculating look.

I turned, as a distant engine revved. Headlights flashed somewhere down the road, bouncing in and out of sight until at last a covered jeep rounded the final curve and pulled up behind my muddy rental. The rain had almost stopped.

"Kyle!" a woman's voice called.

"Terri? Hey Terri! I didn't know you'd be here. All right! Man, it's been years."

She hopped out of the jeep and hugged me, then Derek came around and we shook hands, grinning like idiots. "You look good," she told me.

"You too." And it was true. Terri was Hawaiian/Chinese/French/German; tall, thin, and strong as the earth. She still wore her hair long and straight, still gazed right inside me with those wide, dark, honest eyes. For five years she'd been the manager of the Manawainui Preserve, a tract of rain forest high up on the eastern slopes of Haleakala, one of the two volcanos that made up the island of Maui.

"I thought you were supposed to be at a conference in New Zealand," I said.

"Busy. Couldn't make it."

"Things have been jumping around here," Derek said. "That's why we were late. Hey, grab a seat." He went inside, came out again with a bottle of wine, a box of crackers, and three plastic tumblers. "Did you see my latest creation?" he asked, and nodded toward the bird.

I glanced at it. It was wide awake now, its dark eyes gazing coldly at a moth that fluttered around a nearby light.

"I was wondering if that was one of yours. It looks a little . . . primeval."

"It's called an o'o," Derek explained. "*Moho bishopi*, or Molokai O'o, if you prefer. A delicate species, territorial in habit . . . extinct for over a hundred years."

"Lovely."

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Derek was a creationist. That is, he was a geneticist who specialized in recreating extinct lifeforms. Just raid a museum, give him a few tissue samples from the preserved carcass of some extinct organism, set him down in the lab facilities at U. of Washington, and wait. Within a few months he'd have a transcript of the creature's DNA code, compiled from information still surviving in the ancient cells. Give him a few more weeks and he'd hand you the assembled chromosomes, ready for propagation. For the past three years he'd been working for the Hui Aloha Aina, a powerful preservationist group devoted to the Manawainui Preserve.

Terri walked over to the bird and encouraged it to hop up on her curled fingers. "Hawaiian birdcatchers, the *kia manu* who collected feathers for the nobility's ceremonial capes, were supposed to have kept o'o as pets. We thought we'd try."

"It's illegal for us to have it," Derek said. "Wildlife laws and all—so keep your mouth shut."

Terri moved her hand slowly up and down until the bird spread its wings for balance. It really was beautiful. Then she let it step back onto its perch. "You know that there were no native land mammals in Hawaii before people came here."

"Sure." I had a minor in natural history from my U.H. days.

"No reptiles or amphibians either. It seems odd, but except for *pueo*, the owl, and *io*, the hawk, these beauties were the ultimate predators in their ecosystem."

"Eating bugs."

"Yes, fierce carnivores—when they weren't drinking nectar."

Eden on Earth, I thought, and remembered a lecture I'd heard once by a professor of exobiology who was adept at drawing parallels:

Imagine a generational starship, self-sufficient for a million years, never calling at any port, creeping through space, through the deep, a tiny world to itself where change runs at the slow, slow pace of genes. With no in-migrations to throw the ecosystem off-balance, it can adapt to itself. Competition becomes more theoretical than real. Low reproductive rates become the norm: plants and insects lose their toxins and their thorns, their bites and stings, their ability to disperse. . . . No longer are defenses necessary, because everything is in balance. There is predation, yes, a natural function of any system, but finely tuned, with a minimum of waste. The ecosystem begins to function almost as a single organism. . . .

We already have an analog of this imaginary ship: the isolated islands of the Hawaiian archipelago.

Except that "had" would have been the correct verb form. Fifteen hundred years ago the ancestors of the Hawaiian people found these islands. They arrived in great double-hulled canoes, bringing pigs, dogs, rats (by accident!) and plants of their own, clearing land and changing the look of the coastlines. After them, the Europeans came. In the two hundred and fifty years since Captain James Cook made landfall on Kauai, introduced plants, introduced animals—especially cattle, goats, pigs, deer—and introduced diseases have destroyed or displaced millennia of evolution. A few

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pockets of native forest still survive in the rugged mountains, but in a state far from pristine.

Derek pulled out some rickety old chairs and we sat down at a small card table.

"How are things at the preserve?" I asked.

"Bad," he said. "Real bad."

"We can't keep up with it," Terri said. She shook her head sadly. "I don't care how many people we have, we can't keep foreign plants and animals from invading the preserve. The system's just too sensitive. Our very presence there has an adverse effect on the forest."

"Damn shame."

"Damn waste," Derek said. He reached for the bottle and topped off everyone's glass, a good cabernet from a Maui vineyard. "A living laboratory of evolution, as they say, gone to Hell."

Sheet lightning flickered in a cloud bank somewhere off the coast and we turned to watch.

Talk wandered on to other subjects. They asked me questions about Kasorsky Biological Station and I tried to answer. K.B. was one of those New World projects, the end result of the vogue in long-term planning we'd enjoyed for the past few years. Her end-goal was the terraforming of Venus. In the intervening centuries—or at least for the remainder of this one—she would conduct research on various Earth eco-systems, evaluating their relative merits against the eventual needs of the large orbiting colonies we all believed would be built one day. Opponents argued her only purpose was to amuse malnourished evolutionists and ecologists. That, of course, is not true.

Terri tipped her chair back, so that it balanced on two legs. "Remember when we were kids?" she asked, giving me a hazy, nostalgic smile. "And our parents would take us nightfishing at Mokuleia?"

"Sure. Afterwards, we'd make a bonfire on the beach, and tell ghost stories. You always thought the stories were real, especially the ones your mother told." Terri's mother had been one-half Hawaiian and I swear she knew every hair-raising story ever devised about the *akua*: the ghosts and the gods of ancient Hawaii. Some fears are irrational and deeply ingrained. I shivered then, just thinking about her tales.

"I still believe them. Now, more than ever. . . . And I've got one for you."

"Yeah?"

There was a loud splash in the nearest *lo'i*; probably a toad. Derek shot a look over his shoulder and laughed nervously—the perfect accomplice. Terri kept her eyes on me.

"Been having trouble with ghosts?" I asked, trying to be funny.

She nodded. "In the preserve."

"Oh." I didn't glance at the dark and the rain beyond the dimly-lit lanai . . . though I wanted to. I wasn't going to let her scare me . . . though it was the perfect night for her to try.

"We released the o'o last spring," Terri said, speaking in a low, clear voice as if she were giving testimony at a criminal trial. "Twelve individuals, all mature. I went back about a month later and released four more."

"Great."

"Yes. They seemed to be doing well.

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Then I broke my leg trying to get down a waterlogged trail at Ahulili. I was laid up all summer; the preserve went on hold. Nobody was up there that I know of, from June to early September. So nobody felt the change."

The rain picked up again, a steady drumming on the roof; Derek stared at the table, his fingers laced in a tight weave. Very softly he said, "Apparently the birds had started breeding."

Terri nodded. "It was an experiment, trying to put the forest back together. And as with any complex experiment, there were . . . unexpected side effects. It seems that things stranger than birds and flowers were lost when the forests were destroyed."

Derek pushed his chair around so that his back was to the house, not to The Night. The chair legs made an awful scraping sound on the cement. He said, "The world used to abound with gods. Maybe they were more than imagination."

I laughed at him.

Terri smiled. "It was late afternoon," she said, "when a helicopter dropped me off in the Kuiki grasslands. We went hiking there once, Kyle, remember?"

"Sure I do." The "grasslands" was an eroded planeze 6,000 feet above sea level on the windward slopes of Haleakala. Once the tract had been fertile, but a hundred and fifty years of browsing by introduced goats and pigs had stripped it of its vegetation. The subsequent erosion had removed up to six feet of soil in some places. Only a few gnarled ohia trees survived there, amidst a patchwork of bare lava and non-native grasses. The goats were gone now, removed in the late eighties by the National Park Service, but the land would need centuries to recover—if it ever did. Terri's preserve, with its dense forests, was on the lower slopes, where rainfall was higher and less damage had been done.

"I walked down to the forest," Terri said, "and set up camp where I always do, in a small patch of moss and ferns between the trees.

"A full moon rose around eight o'clock that night. It cast a gray light across the forest and washed out all but the brightest stars. I watched it for awhile, then crawled into the tent and fell asleep.

"But about midnight a gust of wind blew through camp, banging together the aluminum dishes I'd hung on a tree to dry and waking me with a start. I listened, and heard strange yippings —like lost puppies crying. It was the call of *'ua'u*, the seabird that nests in burrows in the cliffs above Kipahulu Valley. Strange, I thought, that they'd be stirring. They're birds of the twilight, flying in to shore at dusk, and out to sea again before the sun rises. In the middle night they're quiet. So something had disturbed them.

"I sat up in my sleeping bag, trying to be silent . . . but the tent floor crackled as I moved. The outer door was partially unzipped. I leaned over and peered through the screened slit.

"The gust of wind that woke me had passed. The camp was quiet again. But there were groaning sounds in the forest. A loud *crack!* wrenched the air, followed by a rush of twigs being torn apart as a tree branch fell.

"The wind came again then, this time

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in a flurry of gusts that shook the treetops and blew dark clouds across the moonlit sky. I wriggled out of my sleeping bag, unzipped the tent, and hurried to quiet the clatter of the pans. With two pots and an aluminum cup clutched in my hands, I paused to listen.

"There was the sound of wind soughing through the trees; the lonely moans of branches as they scraped against each other . . . and on the edge of hearing a low-pitched trilling . . . as if the wind had made a flute of some beetle-drilled bough and was playing it in minor key.

" 'Imagination, Terri,' I told myself, holding my breath to hear. But the breeze was gaining strength, and the sound—if it had ever existed at all—was lost in its roar."

She let a few seconds of silence fall there. Her eyes grew distant, her gaze wandered away from mine, restless, shifting to the attentive bird, to Derek, then finally resting on the dark that surrounded our little light. A chill walked with insect legs up and down my spine.

"It says something of the strangeness of the night," Terri said, "that I could sleep at all, but I did. For awhile.

"At three o'clock I awoke again. I checked my watch: the liquid crystal figures said 3:00 A.M. exactly. The wind had died, but there'd been rain, and water was still dripping from the trees onto leaves, onto my tent, splashing with a sharp, slapping sound—*pock!* The forest seemed to be moving around me.

"Inside my tent, the darkness was impenetrable. I lay still, eyes open on nothingness, waiting. There was no humming, no drumming—only the quiet drip drip of stray raindrops falling on the tent. Yet I felt a presence all around me." Her eyes closed, and she smiled, peaceful. "Its aura was cool," she said, "like leaves under moonlight, humus on the forest floor, tumbling mountain streams. Vast, like the roots of volcanoes. And old—yet younger than the sea. It seemed to permeate the life forms of the forest: the plants, the birds, the snails, the insects and—*me*."

Her eyes flew open. "Kyle, it was in me.

"Oh, my thoughts still moved in their own channels, but at the same time I could feel traces of the other. Something that breathed in diurnal rhythms, echoing the slow flux of energies in the day/night/day/night cycle. It wasn't evil, no; but not beneficent either. Only existing. *In me*. I trembled when I realized *that*. I didn't dare look to either side."

She steepled her hands, pressed the tips of her fingers against her chin, eyes fixed on the table. "Yet even in that moment, I'm not sure I wanted it gone. *Who?* I thought, and maybe I formed the question with my lips. *What are you?* And immediately the presence began to withdraw. It was a spirit, seeping out of my nose and mouth. I stopped breathing, hoping to catch it, but it slipped away. The wind rustled briefly, then silence."

Derek let out a long breath. I swallowed. "Good story," I said. And tried to laugh.

Terri looked up and caught me with her remarkable eyes. "But Kyle, it isn't finished yet."

"Oh."

"I wondered: *what could it be?*"

"The spirit of an old kahuna," I suggested. "A Hawaiian priest."

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She shook her head. "No. I could tell it was not human, it was too strange, I could sense that much. And . . . it was a timeless thing as well. It couldn't conceive of past and future as we do; for it, only the present was real. My questions had disturbed it you see, because to ask a question implies expectation and expectation demands a future.

"So dawn came—a bright morning—and I decided to stay, against all nocturnal intentions. Maybe I was enchanted even then, I don't know . . . but I wasn't afraid anymore. And there was work to do.

"In the preserve, even routine observations are fun. I watched a community of apapane—little red-feathered, black-winged birds—hunt nectar in the ohia trees. I saw an i'iwi and a crested honeycreeper. Then I sighted a pair of our o'o and followed them around, making notes and taking pictures; they seemed to have a nest somewhere nearby.

"But it wasn't long before the birds finished their morning foraging, and fell silent. I turned to my transect lines after that, vegetational surveys that allow us to track changes in the preserve. As the morning passed, clouds built up over the slopes, and by noon the rain began. I kept on. It was past two o'clock when I clambered across a shallow gully, water streaming in my eyes, and paused to rest.

"In the cloud-wrapped forest everything was gray except for the occasional blooms: red lehua or purple ohawai. It was a separate world—so isolated—an island of timeless past. I leaned against a fern-encrusted tree to catch my breath, listening to the stillness around me. I was the only animate creature anywhere to be seen. For a moment I felt as if I'd slipped in time and space to a jungle that had never known humankind. I felt small, like a nervous cricket crouching under a leaf, shivering in the rain.

"It was then that the sense of *presence* returned to me. It came slowly, so that I didn't notice it until it had been with me for a time. Then a dark shadow flitted across the edge of my vision. I turned instantly—but all I saw were rain-wet leaves and moss-laden branches. Yet the awareness was there, as strong as last night, in me, in the forest, in every nearby living thing.

"Until then, I had almost convinced myself that the incidents of the night had been a dream. But I wasn't sleeping now. *'E kala mai,'* I said softly. 'Go on, akua. Leave me alone. Please.'

"I didn't run, though I wanted to. I kept to a walk, concentrating on building up false images in my mind: I wasn't really alone and far from home; no, friends were waiting around the corner; food and warmth were only a few minutes away.

"In an hour I'd made it back to camp. I stripped off my wet gear and dove into the tent, burrowing into the sleeping bag and pulling it up over my head. By the time evening came around, I was almost calm again. But the presence hadn't left me. It stayed with me, the whole time I was there."

Terri sighed. "I got used to it, Kyle—that's the scary part. I learned to live within it; I *liked* being part of it—for awhile. I stayed for days and while I was there, I suffered no human doubts, no human expectations. It was wonderful. Especially late at night, when I was only half-awake. Then it was like a drug haze, a tremendous sense of inevitability and changeless-

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ness. This akua, this forest spirit had learned during fifteen hundred years of Hawaiian occupation all about human needs. It knew mine perfectly.

"My food ran out eventually. Other than that, I'm not sure I would have left."

Derek stirred. "I went back with her later," he said. "And everything she says is true."

"Except that the sense was weaker . . . in company. Synergy. It was harder to forget our human selves when we were both there to remind each other of what we were. It's a true story, Kyle. Do you believe me?"

I blinked. *Are you kidding, my dear?* "No."

"But it's true."

"Sorry."

"Well. That's good, I guess."

"Huh?"

She looked at Derek. I followed her gaze and saw him nod. "We wondered what it was," she said. "And where it came from . . . because it hadn't been there before. What had changed? we asked ourselves. What, except that life had been returned to the forest. Organisms once extinct were again part of the community. An *ancient* community: whole, balanced . . . functioning as a unit. Could this be the answer? Could the akua be a byproduct of a finely tuned ecosystem? Even as the mind is a byproduct of that organic system we call the brain?"

"You've had too much wine," I said. "You always talk too much when you've had too much wine."

"Kyle," she chided. "Just think about it for a minute, please. What is an organism, except a collection of discrete cells existing together in a fixed yet flexible pattern that allows the free exchange of information? Substitute discrete organisms for cells, design a method of communication between the parts involving a high number of associational paths . . . why should a superorganism *not* exist?"

"By 'communication' you mean telepathy, psionics."

A tiny smile flickered across her lips. She knew that subject was a sore point with me. "Telepathy might work—"

"Uh-uh." I shook my head. "Never has; never will."

"—until you consider that most of the organisms involved don't possess enough neuronal matter to constitute a brain."

Derek spoke up. "Of course we could postulate auras, intuition. Psychic phenomena that don't require higher brain function. Some people will tell you that all life forms have a latent awareness of other life forms—an expanded Gaia hypothesis."

"And the world is carried on the back of a turtle," I snapped.

Terri laid a soothing hand on mine. "There are more mundane forms of communication that might work too," she said. "The human mind may be nothing more than an intricate set of chemical reactions, yet apparently that's enough to produce thought, civilization, K.B. station. Suppose in the eco-organism, pheromones serve as an analog of the mind's chemical messengers. Communication by airborne scent would be slow compared to the electrical impulse generated in a nerve cell, but a pheromone has the advantage in range. Insects can detect certain substances over a distance of two kilometers."

"Humans don't possess the analytical

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chemistry equipment of insects.''

''So far as we know.''

''Neither do snails or o'o. Or trees.''

She laughed softly. ''Maybe. Maybe not. There's a lot we don't know about communication—or about the brain; the mind. But maybe *you'll* have a chance to find out.''

Inexplicably, I felt my chest go tight. ''Me? What's that supposed to mean?''

She held up her hand. ''In a minute. First, there's one more thing you should know.''

I waited, wary.

''We—Derek and I—believe that if it can, this akua will assimilate all life forms into itself, into a single superorganism—the forest. It must do this to survive. Alien forms like you and I can't coexist with it for long because we disrupt the pattern in which it finds its existence. So it *must* guide us toward a state of compatability.''

''But Terri, *how?*''

''Remember the drug haze, Kyle? The ability to induce an effect like that would be a wonderful adaptation for disarming a dangerous intruder. And don't forget: human, o'o, or snail, we're all Earth organisms. We share the same biochemical pathways. It's not as if a new communications system would have to be devised every time a strange creature entered the woods.'' She drew in a deep breath. ''So. Either we change and are absorbed by the akua . . . or we die.''

''Or it dies,'' Derek said. ''More likely.''

Terri grunted an agreement. Apparently that was not the option she preferred.

''Be careful next time you're in the preserve,'' I suggested. I didn't say it nicely.

''I will. And I want you to be careful on K.B. station.''

My eyebrows rose.

Derek said: ''You know Mackenzie's been collecting ecosystems for K.B.''

''Sure. That's why the station exists.''

''She had a Costa Rican rain forest scheduled for the third deck of sector three, but that fell through. Wars, she said. Too many biologists killed trying to collect specimens. So she gave that deck to us.''

''To you? Mackenzie didn't say anything to me—''

''You've been on the road for weeks; she couldn't catch up with you to let you know.''

''A true story, Kyle,'' Terri said . . . as if it cost her. ''I wish it weren't, but I had to tell you before you go. In the void . . . it's always night, isn't it?''

There aren't many people in the huge vaults of K.B. station. From horizon to upcurving horizon, only jungle. It can make a man feel very small. On the third deck of sector three the Manawainui Experimental Forest is thriving; has been, for nearly five years. Soon, it'll be time to introduce the birds —honeycreepers, parrotbills, and of course the o'o—and then the system will be complete.

Lately, I've started thinking about Terri again. I try to remember a time during our long childhood when she played a prank on me. I can't. Terri never joked. I told her story to some friends on K.B. station. I make sure I'm never alone. ■

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on gaming

Matthew J. Costello

Sometimes it's hard to ignore a phenomenon.

Case in point (as Rod Sterling would meticulously state, his cigarette poised in mid-air), the wild success of FASA's BattleTech series.

But first, a bit of history.

A few years ago FASA introduced a new game called *Battle Droids*. It was a game of massive robot-like vehicles battling in the 31st century. The 31st century is a new Dark Age where five "Successor States" battle for control of once-flourishing worlds. The "Battlefield Technology" that created the powerful fighting vehicles has come to an end. Spare parts are nonexistent, and water and food are in short supply. The game featured rules for movement, combat, and operation of the fighting machines, two game boards with different terrains, and two plastic models that you could build.

I built the robots, but the game itself didn't inspire me. Undoubtedly thorough, it lacked the flavor that, for me, is absolutely essential to make me want to play a game. It seemed to be such a straightforward game of futuristic combat that it didn't interest me.

And boy, did the parade pass me by.

First, there was a name change. The term "droid" was apparently controlled by George Lucas of Lucasfilms and FASA changed the name to *BattleTech* (FASA Corp., 1026 W. Van Buren, Chicago, IL 60607; $20.00). Droids became BattleMechs, or "Mechs." Gone were the plastic models, replaced by colorful cardboard cut-outs. The first modules appeared (one of which, *Tales of the Black Widow*, features the "Rambolina" exploits of the Black Widow Company Commander, Natasha Kerensky) and, before long, BattleTech was the hottest thing in the game world since the invention of dice.

The sales of the game were impressive. When the game market took a severe downturn, the BattleTech line expanded. Other games were introduced to elaborate upon the mythos. *AeroTech* ($15.00) simulated space combat between the Drop Ships that deliver the Mechs to a hostile planet and fighters. *MechWarrior* ($12.00) is the role-playing game of BattleTech, detailing how to generate characters, personal combat, equipment, skills, and added BattleTech history.

The *CityTech* ($20.00) game gives a good indication of why the game system has grown so popular. The well-organized rules detail how to battle in an urban environment. And any fan of historical simulations (such as the Avalon Hill Game Company's *Advanced Squad Leader*) will find the combat rules more than adequate to cover any contingency.

There's also a three-page story called *Life in the Big City* where we get to see some grizzled Mech Warriors hanging

(continued on page 191)

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Larry Niven

THE SMOKE RING

Conclusion

The trouble with very long-range plans is that those responsible for carrying them out tend to develop plans of their own!

Vincent Di Fate

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Levoy's Star **(Voy)** *is the ashes of an ancient supernova, a "cold" neutron star of half a solar mass, probably on the order of a billion years old.*

A gas giant planet circles Voy at 30,000 kilometers. Goldblatt's world **(Gold)** *orbits within, and continually leaks its atmosphere into a gas torus surrounding the neutron star.*

A gas torus is inherently thin; but at the median line the air is thick enough to breathe. It has the appearance of a green-tinged **smoke ring:** *clouded by water droplets, and green with life that has been evolving in free fall for a billion years. The Smoke Ring is illuminated by a G-type companion star, and includes rock and water and soil lost from Goldblatt's World during its first catastrophic approach to Levoy's Star. Its volume—the foggy region dense enough to support life—is around thirty times the Earth's volume.*

Five hundred years ago, men entered the ecology, via the interstellar ramship **Discipline.**

Sharls Davis Kendy *(once a Checker for the State on Earth, now a computer program for* Discipline*) does not remember a mutiny. He must have edited those memories himself. He knows only that he abandoned his crew to their fate within the Smoke Ring.*

Surely the tools and knowledge the mutineers took with them will eventually help them to rebuild within the free-fall environment. Once they have something like a civilization, Kendy can help them rebuild the State. For more than five hundred years he waited in the L2 point outside Goldblatt's World.

Recently he was able to speak to twelve tribespersons who had captured **CARM** *#6 before the ancient Cargo and Repair Module dropped back into the Smoke Ring.*

Humans have turned strange. Tree-dwellers run around two and a half meters tall. Jungle dwellers grow taller yet. Deformations are common—legs of different length, even no legs—and are not considered handicaps. Their toes are like stubby fingers. Humans of normal size are called "dwarves." They may be poor material on which to build a new State; but what else is there?

Kendy waited twenty Earthtime years, then set forth to find CARM #6. He now knows that his twelve contacts have settled a sixty-kilometer tree. It presently orbits west of the fourth Lagrangean point, the point of gravitational equilibrium sixty degrees east of Goldblatt's World. They call themselves **Citizens Tree.**

Humankind is few but has spread far. Some settled the cotton candy jungles, fluffy puffs of vegetation that grow up to several kilometers across. Some settled the tufts of the integral trees. The trees grow up to a hundred kilometers long; tide holds them vertical to the neutron star Voy. The tufts are the only place in the Smoke Ring where one may live under gravity. But six refugees have brought word of a much larger civilization. The Admirality—a denser roil on the Smoke Ring arc, a point of gravitational equilibrium sixty degrees ahead of Goldblatt's world—houses a civilization of over a thousand people, not counting children.

Kendy's contact is the last remaining Cargo and Repair Module, CARM #6. Kendy persuaded **Jeffer the Scientist,**

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and Jeffer persuaded several others, to steal CARM #6 and move it near the Admiralty. At present the CARM is hidden outside the Clump, with Jeffer aboard.

The others—Citizens Tree citizens **Rather, Clave the Chairman,** *and* **Debby,** *and two Admiralty citizens* **Booce** *and* **Carlot***—entered the Admiralty as loggers with a log to sell.*

The Navy is aware that they also have metal to sell. They are waiting for the Navy to name a price. Waiting isn't easy. If the rest of the Market learns of the metal embedded in their log, there is danger it may be stolen.

Booce believes he has solved this. His rival, **Hilar Belmy,** *has loaned him money against the worth of the metal Wart. Belmy is trying to grow burl from a live tree; he will need fertilizer (and advice that has been supplied by Kendy). Booce will take* **Logbearer** *into the Dark, the uninhabited center of the Clump, for fertilizer and whatever else he might find.*

The Admiralty is all that Citizens Tree expected: crowded with humankind, seething with steam rockets and the Navy's more advanced alcohol rockets. There are esoteric tools and a variety of earthlife crops in the Market.

Booce has managed to hide the silver suit in such a way that its camera has a view; thus Jeffer (and Kendy) can stay in contact. Kendy has learned much, but not nearly enough to satisfy him. Booce has spoken of a Library, and it sounds like the control board from a ruined CARM. Its computer memory would supply records from half a thousand years of Admiralty history.

Problems arise. The Navy wants Rather. They have three silver suits to fill, and they give preference and rapid promotion to dwarves. In particular, if **Captain-Guardian Wayne Mickl** *can cause Rather to fill a silver suit, it will free Mickl to move up in rank.*

Rather has no wish to join the Navy; but pressure on Booce forced him to appear for an interview. Rather induced an allergy attack and arrived sick. He was not wary enough to hide his tide-developed strength. They want him. So does **Sectry Murphy,** *another dwarf, a lovely redheaded Navy ensign; and Rather does not want to lose her good opinion. The Navy seems to have him surrounded.*

SECTION FOUR: THE DARK AND THE LIGHT

Chapter Nineteen: The Dark

From the Citizens Tree cassettes, year 54 SM

We've had serious arguments about why Kendy cut contact. Maybe something just burned out some circuits. Mass does constantly rain out of orbit onto Voy—make that Levoy's Star, my apologies to Sharon. A big infall would cause big magnetic storms, maybe big enough to burn out *Discipline*'s computer, and the thick Smoke Ring atmosphere would still shield *us*. I hate to think so. I liked Kendy.

That sounds crazy. A computer program . . . I can't help it. Kendy had less imagination than the turkeys. I tried telling him a joke, once and nevermore. But I admire dedication, and Kendy had as much dedication as a man can stand. I'm going to leave this in.

Judd Quinn, Life Support

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* * *

Booce had bought a small pump. Rather was working it to fill *Logbearer*'s fuel tank. A Navy ship was doing much the same on the other side of the pond. Water had to be shared, this close to the Market. Greetings had been exchanged, and now the two crews were ignoring each other.

Carlot said, "Raym's been running messages for Dave Kon and Mand Curts. They'll know where he is. You'll have to track him down, though."

"No problem," Booce said. "How did he lose his rocket?"

"I didn't want to ask. He's far gone on fringe spores, Dad. We want him, *but I don't want him in charge of anything.*"

"Fine. Rather, stop, it's full."

Rather began packing up the pump and hose. "That was quick," he said, remembering how long it took to fill the carm.

"A pretty good pump for something that's all hardwood. Let's get going. Carlot, you drop me and Clave at the Market and then go on to the house. Clave, you get the rest of the seeds. I want to buy us some clothes. You're all still wearing tree-dweller pajamas."

"You'll bring Raym?"

"I'll send him to the house. If he's too fringey to find it, I don't want him aboard any ship of mine."

Rather had not found the chance to confide in anyone but Debby and Carlot. Maybe that was good. Booce seemed to take it for granted that he would stay where the Navy could find him. Rather's plans were quite different.

Would Carlot help him? He wasn't sure. The way she was acting . . .

The Market swarmed like a hive. When the rocket came near, a dozen citizens separated from the pattern and flew to look. Booce delayed his exit for dramatic reasons. When he emerged he was surrounded. He stayed to talk, and Carlot joined him. Clave grew bored and flapped off toward the Vivarium at the far rim. Booce took an order for a thousand square meters of wooden planks . . . and the sun crossed half the sky and was behind the Dark before *Logbearer* moved on.

Serjent House continued to drift. It was now radially out from the Market. The Dark eclipsed the sun; Voy shone from the side. Half-violet, half-black, the cluster of cubes made an eerie sight.

"We'll have to tell Clave," Debby said. "First chance we get."

Carlot said, "I'm still not sure about this."

Rather said, "Booce was right, wasn't he? I want to look undependable. So—"

"They'll think you had Dad's permission!"

"The Navy doesn't own me. Booce doesn't own me. Even you don't own me, Carlot, and if you're holding me as a copsik I want to know it so I can think about escaping!"

"No, I don't own you." The ship was turning, decelerating. Carlot was very busy tending the rocket, too busy to look him in the face. Her voice was almost inaudible. "But it was a fool stunt, running off to make babies with that Navy woman."

"You're going to marry Raff Belmy."

"I said *probably*. Skip it. It was a

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fool stunt. So tell me this. Does Clave own you? Your Chairman?"

". . . Maybe."

"So ask *him* whether you're going."

"I want to talk to Jeffer too. And one other."

"You keep hinting—"

"You'll see for yourself. You too, Debby. I am treefeeding tired of keeping secrets."

A random comet had impacted Levoy's Star. It had reached the surface as a stream of gas moving at thousands of miles per second. The neutron star had rung like a bell. There were two hot spots on the rapidly spinning body, at the impact point and the point opposite, where the shock waves had converged. The violet ion streams that normally rose from the magnetic poles of Voy, which natives called the Blue Ghost and Ghost Child, were brighter than Kendy had ever seen them. Radiation was beginning to sleet against *Discipline*'s hull.

But Kendy spared instruments for the CARM.

He ran the record as it came in. Jeffer had been idle: not much there. The house had been empty most of the time. Ah, here was something—

The motley collection of metal and plant tissue the savages called *Logbearer* bumped the wall nozzle-first. Rather, Debby, and Carlot emerged. They tethered the steam rocket to the door, close enough to block the sky. Rather said, "Jeffer. Come in, Jeffer."

Jeffer had been reviewing records from the cassettes. He set up the link. "I'm here. Hello Debby, Carlot, Rather."

"I'm in trouble," Rather said.

"Tell me."

"Petty Wheeler interviewed me for the Navy."

"How did it go?"

The depth of Smoke Ring atmosphere was blocking most of the radiation and X-rays, and Kendy's instruments too. He could still watch events on the star itself via neudar. A plasma cloud hovered over the impact site, several centimeters high and spreading at terrific speed along lines of magnetic forces—

Rather said, "Scientist, I did everything right except only two things. I did what Booce told me. I slept in the silver suit with the humidity turned low, and got there sniffling and crying. Debby came with me, and I really did need supervision. I could hardly see where I was flying. I asked for Sectry Murphy: all seeds and no brain, stet? But Booce didn't tell me not to show off my muscles, so I did."

"You're strong but sickly."

"And I'm a dwarf. If enough dwarves get into the Navy a certain Captain-Guardian Mickl gets to act like an officer. I'm quoting Sectry. Mickl watched the interview."

"Two mistakes. Did you suggest marriage to Bosun Murphy?"

Laughter, chopped off. "We got high on fringe tea. Then we dived into a puff jungle and—" Quick sidewise glance at Carlot, whose face was like stone. "Jeffer, none of us ever thought she might take me up on it. Now she thinks I'm joining the Navy and making plans to marry her. Maybe she can hold me to it!"

"This is not to your taste?"

"Sectry . . . I don't know. I don't

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want to join the treefeeding Navy and I don't know how to tell her that!"

"Okay, I'm thinking. . . . Rather, they already know you're allergic. Let them train you. Carlot said they don't give you much sleep in training. Stay awake even when you don't have to. Get sick a lot. They'll give up."

"I thought of something better."

"Listen—"

"No, *you* listen. I went running to Carlot and Debby. Help, I said. I'm in trouble, I said. The Navy wants me. What do I do? And we talked it over, and what I want to do now is talk to Kendy."

Jeffer's medical readings showed his shock. Kendy stopped paying attention to the impact on Levoy's star. *Paydirt!*

"Rather? You told them?"

"I'm letting you tell them. You and Kendy."

"Kendy isn't in range yet. When he gets the record—"

Carlot said, "Kendy the *Checker?*"

"The same," Jeffer said. "Kendy made contact with us fourteen years ago . . . fifteen now. I made a mistake with the carm. Kendy told us how to get home. We didn't hear from him again till . . . well, it was just before you showed up, Carlot. He wanted this expedition."

Debby was seething. "Jeffer, you treefeeding mutineer! What game did you think you were playing, hiding a thing like this?"

Carlot exclaimed, "You can't deal with the Checker! We know all about—"

The record was finished. He'd reached present time. Kendy printed I'LL HANDLE IT across the bow window in front of Jeffer. He sent, "We told Clave. Rather was there, so we told him too. Hello again, Debby. Carlot, it's a pleasure to meet you at last. Rather, you did the right thing."

"And I suppose you'll try to talk me into joining the treefeeding Navy! But I won't do that, Kendy. I want *out* of this."

Rather wasn't aboard the CARM. Kendy couldn't get medical readings; but he sensed truth here. Never give an order that won't be obeyed! Try something else . . . while *Discipline* moves steadily out of range. Wrap it up fast, but wrap it tight—

Kendy asked, "Rather, what are you planning?"

"Remember Booce telling me to look undependable? The Navy expects me to stay in touch. I'm going Dark diving. Carlot and Debby and Clave are taking *Logbearer* to get mud from Belmy's burl tree. I'm going with them."

"Just to look undependable?"

"It's not a crime. Sectry'll hate me, and I don't like that, but it'll get me off the harpoon."

Kendy finished putting details on his own plans. The speed of his thoughts was one powerful advantage to being a computer. It helped win arguments, too. He said, "That's good, but it's not enough. Not if this Wayne Mickl wants you so badly. We need to get you out of the Clump entirely. Mmm . . . Rather, I think I may have something. Booce was planning to take the helmet with him so that Jeffer and I can see the Dark. Still true? Carlot?"

"Stet. Dad wants it out of the house."

"Good. Take the whole suit. Take Rather too. Go into the Dark. Rather,

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the suit's fully fueled. When you're out of sight of the Market—"

They heard him out, looking at each other. The silence that followed lasted only five or six seconds, but Kendy found it excruciating. Then Jeffer asked, "How long have you been planning this?"

"About thirty seconds . . . twelve to fifteen breaths. I think faster than you do, Jeffer."

Carlot's voice held doubt, not anger. "It's mutiny—"

"We steal *nothing*," Kendy said. "We won't harm the Admiralty at all. The information doesn't disappear, but I can read it, and then it becomes available to Jeffer the Scientist. Rather, Debby, don't you see? We came to learn. Clave and Jeffer won't leave until they know what to tell Citizens Tree about the Admiralty. This way we'll learn everything we want in half a day."

Rather said slowly, "You say you can tell me how to do this."

"I've taken neudar readings. I can see the gross structure of Headquarters. It's most of a CARM surrounded by a concrete shell." The neudar shadow of the CARM was splayed around its aft end, and the back third was missing. The explosion must have pulped many passengers. It had ripped away the outer door of the airlock too. "The Library must be the control room. I'll guide you. We'll time it so I'm in contact the whole time. Even if someone sees something funny, it'll be *too* funny. He won't believe it. Afterward, you take *Logbearer* home."

Carlot looked at Rather. "I don't owe you this."

"Losing contact," Kendy said. There might have been time for three words more, but what would they have been? He'd simply have to wait.

The redhead found Booce as he was returning from Market. She looked funny, flying. Her legs chugged faster than a normal woman's and made shorter strokes. She wouldn't have caught up if Booce hadn't been pushing baggage.

She wasn't breathing hard, though. She had a charming smile. "Booce Serjent, do you remember me?"

"Bosun Sectry Murphy. We met when *Gyrefalcon* came to collect customs. How do you do, Bosun?"

"I do okay. Rather's been accepted for training. I'd like to tell him."

Rather wouldn't like that. "He'll be at the house."

"I'll come. Shall I help with those?"

They kicked slowly along. Behind them the Dark moved in uneasy turgid patterns, out and east; the sun crept toward Voy; western rain clouds crawled in long curves. To fill the silence Booce said, "We've finished repairing *Logbearer*. After breakfast we cruised past the Market—"

"Moving slow. I saw it."

"Clave went for the rest of his seeds, and I picked up some clothing and toothbrushes. Can't have my crew looking like savages."

"My superiors may be wondering where you found the money."

"It's not easy. The Navy's taking its own sweet time to bid a decent price for our metal. But I've got some orders for wood, and my crew is going Dark diving."

"Did Rather say anything about . . . yesterday?"

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GLOSSARY

BRANCH—One at each end of an integral tree, curving to leeward.
BRANCHLETS—Grow from the spine branches and sprout into foliage.
CARM—Cargo And Repair Module. *Discipline* originally carried ten of these.
CHECKER—Officer entrusted with seeing to it that one or a group of citizens remains loyal to the State. Checker's responsibility includes the actions, attitudes, and well-being of his charges.
COPSIK—Slave. (Derives from *corpsicle*. In the State, corpsicles had no civil rights.)
COPSIK RUNNER—Slavetaker or slavemaster.
DARK SHARK—a predator of the Clump interior.
DAY—One orbit about Levoy's Star, the neutron star. A *standard day* is an orbit of Goldblatt's World.
"FEED THE TREE"—Defecate, or move garbage, or die.
FISHER PLANT—boll-shaped, reaches toward ponds with a long water-inflated root.
FISHER JUNGLE—is a large fisher plant with sting. May attack big birds as well as ponds.
GO FOR GOLD—rush headlong into danger, or disaster, or battle.
GOLD—See *Goldblatt's World*. Secondary meaning: something to avoid.
GOLDBLATT'S WORLD—Gas giant planet captured after Voy went supernova/neutron. Named for *Discipline*'s astronomer, Sam Goldblatt.
HAPPYFEET—Mobile tribes. (An Admiralty term.)
HONEY—Sticky red fluid, used as a lure for treebugs.
HONEY HORNETS—Deadly insects. They secrete nerve poison.
INTEGRAL TREES—A crucial plant.
JUNGLE—describes almost any extensive cluster of plants.

"Not to me. He didn't seem to want to talk. It must have been a strange experience."

She laughed, then grew pensive. Presently she said, "Isn't that Sergent House?"

"Yes, but—" *Logbearer* wasn't there.

Booce invited her in. The Navy woman waited while he made the circuit of the rooms. He found nobody. There were no seeds: Clave hadn't arrived yet.

"They must have left already," he told her. "I stayed to bargain for wood. Clave should have come back well ahead of me." It was puzzling.

"Was Rather going with them?"

"No. He should be back soon, wherever he is."

She accompanied him to the kitchen and watched while he made tea. They returned to the common room and passed the pot between them, all in near-silence. Booce wondered if Jeffer had noticed the Navy woman. What they really needed right now was a metallic voice bellowing out of the door.

"You'd think he'd leave a message," she said.

Booce nodded. *But they'd have left it with Jeffer!*

Murphy was frowning. "It is it normal for Rather to do . . . something like this?"

Booce was quick on the uptake. "He's never done *this* before. Well, he's been worried about whether the Navy'll take him. Maybe he got terminally antsy. A trip to the Dark—" And Booce knew he was right. *If they think you're undependable . . .* Rather had gone into the Dark.

"—could be just what he needs," he finished.

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"It's not what *we* need." Murphy rejected the offered teapot. "How long do you expect them to be gone?"

They weren't seriously hunting treasures such as fringe or blackbrain. All they wanted this trip was mud, so—"Thirty, forty days." But they wouldn't have left without Clave, so they must have taken the seeds he was carrying, too. Why?

"Tell Rather we're unhappy. Booce, I've got to be leaving."

Booce hovered at the door to watch Murphy depart. He whispered, "Jeffer?"

Nothing.

Of course, they took the helmet too. He waited until Sectry was no more than a speck before he opened the compartment in the door.

The whole damn illegal pressure suit was gone.

For one magical moment he was nothing but relieved. But something was going on here, and Booce didn't like it at all.

Carlot made her burn with the bow pointed straight into the Dark. East takes you out, out takes you west. That a rocket might go where it was pointed was contrary to Rather's experience; but he didn't want to argue with Carlot.

The Market passed them at impressive speed. A few citizens turned to watch, and were gone.

Raym Wilby had never kept silence in his life. "This first part of a trip is fun, but you can still get hurt. Carlot, the tank's near dry, stet? Turn us. Cut the water flow. Go in facing sideways."

Carlot looked at him.

"See, if something comes at us, you run the last of the water in. Doesn't matter what way you're facing, long as it isn't forward. Something's ready to hit us, you change course. If it's gonna miss, you don't."

"Oh." She and Clave tilted the nozzle. *Logbearer* started its turn as she cut off the water flow. The slow turn continued as the sky began to darken.

"Birds are the worst. A pond, a glob of mud, a jungle, they don't follow you if you dodge. Everybody got harpoons? Stet. Hey, *smell* that. First whiff of the Dark. State, it's good to be back!"

Logbearer fell straight in. It was like entering a huge storm cloud . . . a granular-looking storm cloud. The air smelled of wet and rot and mustiness.

They strung line, using beams on the nose as mooring points. Raym watched and frowned and told them to put the lines closer together. "It's got to hold the mud while you make the burn." When they finished, *Logbearer*'s nose was the center of a great web. "I always string my extra clothes across the middle of the web. That way you *know* the mud won't go through and all over the cabin. You bring any extra clothes, Carlot?"

She spoke through gritted teeth. "You didn't tell me to. But *yes*, I brought extra clothes, and I don't much like getting them covered with mud."

"So wash them after. You do it when you're ready to leave. Then you use what's dirty. Look there, aft of center. Kerchiefs!"

Kerchiefs looked like a score of scraps of pink and green cloth afloat on the wind. "Those're flowers," Raym said. "Not fungus. They'll—"

"Could you spread those to hold the mud?"

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LEVOY'S STAR—A neutron star, the heart of the Smoke Ring system. Named for its discoverer, Sharon Levoy, Astrogator assigned to *Discipline*.
PRIKAZYVAT—Originally, Russian for "command." Presently used to activate computer programs.
SMOKE RING—The thickest region of the gas torus that surrounds Goldblatt's World in its orbit around Levoy's Star.
SPINE BRANCHES—grow from the branch of an integral tree.
STET—Leave it the way you find it.
STING JUNGLE—Smoke Ring plant, generally houses honey hornets
SUN—a G0 star, also called *T3*, orbits Levoy's Star at 2.5 × 108 kilometers, supplying the sunlight that feeds the Smoke Ring's water-oxygen-DNA ecology.
THE CLUMPS—the L4 and L5 points for Gold. As points of gravitational stability, they tend to collect matter.
TREEFODDER—is anything that might feed the tree: excrement, or garbage, or a corpse.
TRIUNE—A Smoke Ring bird, large and often dangerous.
VOY—See LEVOY'S STAR.
YEAR—One passing of T3 behind Voy. Half of a complete sun-circuit, equals 1.384 Earth years.

DIRECTIONS:
OUT—away from Levoy's Star.
IN—toward Levoy's Star.
EAST—in the orbital direction of the gas torus.
WEST—against the orbital direction of the gas torus. The way the sun moves.
SOUTH—to the left if your head is Out and you're facing West, or if your head is In and you're facing East, and so forth. Along

"Carlot, they're not strong enough. Touch them and they shred. Hey, you don't mind dirty clothes when you're Dark diving!"

They took turns sleeping. The sky thickened and darkened over five or six days. Then Voy and the sun were hidden and it was impossible to know *day*. Rather's eyes adjusted. He saw colors emerging from the darks: blue tinges, green, orange. Behind them the murky sky was a blaze of light, suddenly bluer as Voy passed, too bright to look at.

Raym was forward, inspecting the web again. Or maybe he only liked the view.

Clave said, "It isn't the risk that bothers me. It's the fact that I'm not taking it. Feels like this should be my job."

Rather didn't answer, but Carlot did. "Oh, you're taking a risk. If he gets caught, the Navy'll want us all. Clave, it's not too late to change our minds!"

"Yeah. I know how persuasive Kendy is. And I think I should have been consulted." Rather started to speak. Clave snapped, "Yes, Rather, it couldn't be done. Besides, Kendy's right. It gets us everything we came for. Rather, if you don't come back in a decent time, we're leaving. I've got the seeds. We'll just burn straight out and let Jeffer find us in the sky."

"Stet," said Rather.

"And what about Dad?" Carlot demanded. "Why should the Navy believe him when he tells them he didn't know?"

"I won't get caught. One big risk and we go home."

"I don't owe you this," Carlot said, as she had said before. This time nobody answered. (But Jeffer had said, "You

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owe Citizens Tree for your life," and it was true.)

"I think we've gone far enough," Clave said. "Nobody's going to see us from the Market."

Rather nodded. "But there's still Raym."

"He's easily distracted."

The rocket had slowed considerably. They were drifting, not flying. The murky sky was busy with soft, shadowy shapes. Once there was a jagged rock the size of *Logbearer*, half-covered by . . . Rather stared. That had to be a fungus. But it was convoluted like the moby's brain Half Hand had tried to serve them.

Raym pointed through the net of lines. "You can eat that."

Clave said, "Treefodder! I mean literally. That's a tuft off an integral tree!"

It could have been, Rather thought. There was the curved blade of the branch. But where foliage should have been, now there was a great misshapen lump of soft gray curves. "I pushed one of those home once," Raym said. "Had to. My nets were torn up. It was all the food I had left, and I barely made a dent in it getting home. Half Hand served slices of it for the next twenty days, but he didn't pay much . . ."

Rather tuned him out.

The orange tinge ahead grew gradually stronger. Orange light shining through shadows. Rather had grown used to the wet, musty smell, but something else was in it now. "Raym, what's that?"

"I've been living with Exec ever since the accident. My son, Exec Wilby.

Levoy's Star's south axis. Direction of the Ghost Child.
ROCKET—Term refers only to the steam rockets used by the Admiralty and Seekers.
NORTH—opposite South. Along Levoy's Star's north axis. Toward the Blue Ghost.
DOWN and UP—usually applied only where tides or thrust operate.
SPIN, ANTISPIN, DARK—and SKYWARD are directions within the Clump.
The general rule as known outside the Clump is, "East takes you Out. Out takes you West. West takes you In. In takes you East. Port and Starboard bring you back."

He only went into the Dark but once—What?"

"That."

"That's the fire. Carlot, we have to turn."

Carlot jerked around. "Fire?"

Now Rather knew that smell. Fire burning in something wet and rotten.

"It's been burning down here since . . . I don't know when. All my life, anyway. Never gets much bigger, never gets much smaller. Now, don't hurry. Look around and find a pond and steer for that. We need more water anyway."

They looked. There was no mistaking the shape of a pond, of course, even in darkness. Rather found no spheroids in evidence. Carlot said, "I don't see anything!"

"There."

"But that's . . . oh." Raym was pointing to a fungus jungle, a maze of thick white threads . . . and the orange light glinted off something reflective

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inside. The mass, in fact, was mostly pond, but it was laced with fungus.

Clave used the bellows. The pipefire that had been estivating in the windless murk now blazed up. Carlot blew the last of their water into the pipe while Rather and Clave tilted the rocket.

The fungus jungle drifted across the orange light. *Logbearer* impacted softly against resilient fungus fingers, and recoiled.

"What kind of pump you got? Good. Boy . . . Rather, you want to pump?"

"You pump, Raym," Carlos said. "Debby, you go with him. Keep your harpoon handy."

"Stet, that's good thinking, Carlot. No guessing what's lurking in there." The imaginary horrors didn't diminish Raym's enthusiasm as he flapped away with the pump. The hose slowed him. Debby kissed Rather's cheek before she picked up a loop of hose and flew after *him*.

Raym disappeared among interlocked white strands that broke where he touched them.

Clave said, "Now, Rather."

They entered the cabin together. The bags of seeds nearly filled one compartment. Rather pulled them out, reached further, and had the silver suit.

Debby saw only kicking wings among finger-thick white pillars of fungus. "Nothing dangerous yet," Raym called cheerfully. "Watch for stinkbirds. Great State! Girl, get me a bag, a big one!"

Debby dropped the hose and worked her way in. "What—"

"Fringe!"

"Oh. Here." She'd taken to carrying the big bags they'd used to collect honey while logging. She passed one in. She couldn't see what Raym was doing in there, but the air had turned dusty. She sneezed.

Raym wriggled out in a cloud of dust motes. There was something shapeless in the bag. "Sixty, seventy chits worth," he said. "I'll just take this back—"

"I've linked up the hose. What have you got?" Carlot had come at his shout.

Raym showed her the bag.

"Dammit, Raym, that's sporing fringe! Debby, get away from it."

"Yeah." Debby kicked out into the air. She was feeling dreamy . . . lightheaded . . . happy. But if she'd breathed spores, Raym must have breathed more.

Keep him away from the ship! Debby pulled on the hose until she had the pump. "Raym, take this around to someplace else and start pumping."

"I'll take this back," Carlot said. "Raym, you shouldn't get near sporing fringe! Sure it's worth money—" She gave up. Raym was laughing.

Clave had stuck the helmet to a wall with a dab of glue. It watched him in stoic calm. "Try to do the circle in one sweep," it said.

"Is that how the original was done?"

"First painting was probably a template, but templates wear out. The suits must be painted over and over. Every so often the junior Guardian has to paint it. I'm guessing, of course, but the original looks a little sloppy in Kendy's pictures."

Clave pointed the brush like a pencil and moved in a single graceful sweep. The resulting greenish-white circle wasn't half bad. "Bring it closer," said the helmet. "Too narrow and also a little

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small. Go around again and add some bulk to the outer rim. Rather, when you leave, drape a cloth over yourself. We don't want to get it dirty while it's wet . . . Stet, Clave. Now the dot in the middle. Stet, leave it tiny. Give me another look at the shoulder—"

"Raym found you something, Silver Man."

Clave jumped. "What? Carlot, don't do that."

"Rather, take it. It's sporing fringe. Bring it back if you can. It's worth money."

Rather took the bag. "What's it for?"

"If you're in trouble, throw it. Everyone around you will have a wonderful time while you get away. Make sure *you* don't breathe it."

"Oh. Thanks."

"Sure."

"I'm ready to go."

There was something more that he ought to say, something she expected, but he couldn't for the life of him think what it was.

"You get tired, I'll take over," Debby said.

"No, no, the tank must be nearly full by now." Sweat slicked Raym wherever his skin showed. He was grinning and panting and pumping his legs with the vigor of a much younger man.

The tank must be full already, Debby thought. They wouldn't let Raym stop until—

Raym stopped. "What was *that*?"

Debby turned to where he was looking. "I don't see anything."

Tiny twin flames burned in the Dark, receding.

"Huh." Raym resumed pedaling. "Hope that isn't the fire getting closer. You never know where it's gonna be. It doesn't just drift like everything else, it spreads in spots and goes out in spots—"

Carlot called from the rocket. "Raym! Let's go find our mudball."

Chapter Twenty: The Library

From Discipline*'s records, year 926 State*

Your orders are as follows.

1) . . . You will visit each of these stars in turn. Other targets may be added. Where appropriate you will seed the atmospheres of proto-Earth worlds with tailored algae using the canisters you carry. The State expects to settle these worlds, spreading humanity among variable environments, against dangers that might affect only Sol system.

2) The State is aware that you do not require a crew to operate.

The human species is not invulnerable. There is finite risk that the crew of any interstellar spacecraft may find, on its return, that it has become the entire human race. Your crew and their genes are your primary cargo. CLASSIFIED.

3) Your tertiary mission is to explore. In particular, any Earthlike world with possibilities for colonization must be investigated and reported immediately.

—Ling Carther, for the State

Matter was too thick in here to use boot jets. Rather used them to get clear of Raym's sight, then donned his wings. He wanted to fly straight north, along the axis of Clump and Smoke Ring both.

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Matter should thin out rapidly in that direction.

There were no ponds; but sometimes you could catch a glint of light from one of the fuzzy-edged fungus jungles. There were white pillow-shapes, and flat white lenses streaked with yellow and crimson, and networks of interwoven pale stalks. He took care to avoid touching anything; he flew around clouds of dust or spores. The paint on him would still be wet.

Rather began to understand the beauty Raym found in the Dark. Straight lines, rare in a tree, were unheard of here, save (rarely) for long beams of blue-white or yellow-white sunlight breaking through the murk.

Where he saw these, he corrected his course to cross them. This close to crossyear, north would be at right angles to Voy *and* the sun. After what felt like a couple of days he was seeing many more. The Dark had grown rarified. Now there was room for jets.

He fired a burst of five breaths duration.

Mist flowed past him as he coasted out of the Dark. The day brightened. Too bright. His eyes were slow to adjust.

"Jeffer the Scientist calling Rather. Can you hear me yet?"

Jeffer's voice was scratchy. Rather turned up the volume. "Reception isn't good, but I'm hearing you. I'm nearly out, moving north, coasting. The rest of us are in good shape. How long till we get Kendy?"

"A quarter-day to spare. Rather, did you bring wings?"

"Yes."

"Good. You can't approach Headquarters on jets. I didn't think of it."

"I did."

"I have you located. Make your burn now. You're well north of the Smoke Ring. The air's thin, it won't slow you much, but in less than a half-day you'll be back in the plane."

"I know, north and south bring you back. So. How long a burn? What direction? I'm well and truly lost."

"I'll time you. Three minutes, about sixty breaths. Can you see Voy? The Market is ten degrees west of out from you, and you have to cross four hundred klomters. You didn't actually get very far into the Dark."

By now he'd fallen into clear air, with the Dark spread out below. Rather wriggled to point his feet ten degrees east of Voy. He would move nearly at a tangent to the flow patterns in the Dark.

He lit the jets. His body tried to sag into his boots. The Dark skimmed below him, a storm with granulations in it, and sudden red and golden and purple glows where the sun shifted just right. Jeffer counted aloud and told him when to fall free.

Flying. The Dark was thinning out, but coming closer too. He skimmed through the fringes of a raincloud—

"Kendy for the State," said the familiar deep voice. "Rather, are you on schedule?"

"No problems. Expedition's in good shape. Raym will probably swear I was there the whole time."

"Repeat after me. 'There's a respectable store of metal here.' "

"There's a respectable—"

"Try to say it like I did. Listen a few

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times. 'There's a respectable store of metal here.' "

Rather deepened his voice and tried to spit the syllables. "There's a respectable store of metal here."

They rehearsed. " 'You wouldn't want to have to sell your new house,' " and " 'I need to consult the Library,' " and " 'I relieve you.' " Rather was lethally sick of it when Kendy quit. "It'll have to do. Try to be in a cloud when you sight Headquarters. Don't make your approach without me."

"Right."

"I've displayed a neudar map of Headquarters for Jeffer. He can guide you if I'm out of range. Back in two days. Kendy out."

"Jeffer?"

"Here. Rather, you should try to sleep."

"*Sleep?*"

"Nothing natural can hurt you in the silver suit. Sure, sleep. You'll be less hungry. You've got no food."

"I'll give it a try."

He slept not a wink. The turning of the Clump spiral caught him up and he had to make a correcting burn. Houses and decorated puff jungles passed, none close enough to see more than a passing pressure suit. Citizens would wonder what the Navy was doing out here.

Within a layer of haze he found the unmistakable shape of the Market. Headquarters to spinward . . . "Jeffer? I have it."

"How close?"

"Forty klomters."

"Get a lot closer. Approach from the Market side if you can. Rather, it just struck me: there are two ways into the Library, and they have to guard both."

"So?"

"I don't think it was ever meant to be guarded. The Library was supposed to be free to all. Just a guess."

"What's the word from Kendy?"

"Any breath now."

"I'll come in through that cloud bank. You see it? I think there's a pond in there. I'll come around that."

"Kendy for the State. Rather, are you in place?"

The boy sounded edgy. "Ready. You missed some interesting stuff."

Headquarters was four hundred meters distant. They'd lose a few minutes crossing that. Kendy sent, "Something I should know?"

"No, just interesting. I watched two triune families arrange a marriage."

"If your helmet faced it I didn't miss it. Time to move. Just wings."

Kendy watched the guards as Rather approached. Would they expect him to have an escort? They spread arms and legs as he came near, with a hand and foot to hold the harpoon. That position had been *Attention!* for any military man in free fall since long before Kendy's birth. The door behind them was large and massive, and closed.

"Just go in unless they do something," Kendy said. "I've watched them every orbit. You won't need a password because your helmet's closed. Don't hurry. Let them open the door for you."

Checklist: Communications systems nominal. Drive warming. Course correction ready. Kendy didn't intend to burn fuel until everything else had gone right.

The guards waited until they could

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read Rather's insignia. One rapped the door with his spear butt. It slid open in time to let Rather pass.

"Left. There's a hall, then another door." Kendy noticed pads of cottony-looking vegetation on the far wall. "Pause. Wings off, then clean your suit. You'll be expected to. Pat, don't rub. Remember the paint."

Rather patted muddy rainwater off his suit. Kendy wished he could see the result. There were paint smears on the pad. The boy moved down the corridor.

The inner door had one guard. He starfished the way the others had. "Captain-Guardian? You're early, sir."

"I want to consult the Library."

"But that's . . . yessir." The man didn't move.

Kendy sent, "You're still carrying your wings. Tether them to your chest plate." The guard must expect that, and it would give Kendy time to think. "No hurry. Aristocrats don't hurry. Shin sticks toward your chin."

The door: no hinges visible. It would swing in. What was protocol here? Have to guess. "Open it yourself, Rather."

"How?"

"Paired handles on door and wall. Grip both. Push the door inward. No, pause—"

As Rather finished tethering his wings, the guard finished pushing the door open and moved aside. "In," said Kendy.

Rather entered. He turned at the sound of the door closing. There was no handle on the inside, though a scar showed that one had been removed.

The light source was electric. Would that bother Rather? No, he was used to electric lights in the CARM.

A man in a pressure suit waited. He held a crossbow. The bow and quarrel were both hullmetal: lengths of stiff CARM wiring, with superconducting cores. So this was how they used their heritage.

The Guardian's voice had to echo through helmet and faceplate. He sounded tinny (as Rather would; Kendy had counted on that) and surprised. "Captain-Guardian?"

" 'I know I'm early. I relieve you. I need to use the Library.' "

Rather was slow. "I know I'm early—"

"That's all right, Captain-Guardian."

"I need to use the Library. I relieve you."

"Yes sir. For what purpose, sir? I'm required to ask."

While Kendy mulled possible answers, Rather had started to speak. Kendy listened. Rather said, "We want to locate an integral tree west of here. I want its probable orbit."

No way to read the silver man's face. He said, "Yes, sir," and rapped on the door. It opened for him and closed after him.

"Alone at last," Rather said.

The room was much bigger than the machinery it housed. The CARM control system had been remounted in a wooden cradle. There were wooden handles on its four sides. Hadn't Booce Serjent said that it was sometimes displayed to the citizens?

Cradled against an adjacent wall was a small portable fusion generator. The Library's light source was a panel running around its rim. The power cable was coiled against its side. "Rather, do you see a coil of line, thick as your wrist, black—"

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"Got it." Rather moved toward the generator.

"The free end has to go into a hole in the CARM controls. At the near end, near the wall."

"There are a lot of holes."

"I'll guide you."

They played "cold" and "warm" with the end of the plug. It was taking too long. The power plant might be dead. The computer might be dead. The programs might be scrambled. There would be no second chance: Rather Citizen was probably trapped behind locked doors, with Wayne Mickl already on his way. Once Kendy had established contact with the Admirality, he might be able to buy Rather loose. The boy was doing his best, after all, fumbling, but doing his best—

"Just push it in hard and turn it counterclockwise. Stet. Face the controls. Tap the white key." A white cursor appeared. "Say 'Prikazyvat Voice.' "

"Prikazyvat Voice."

"State your authority," said a voice so like Kendy's Rather squeaked in surprise.

"Say, 'Rather Citizen for *Discipline*. Open contact.' Watch your accent." With another part of his attention he began beaming his signal to the old CARM computer. Voice was activated; the computer would hear. *Kendy for the State. Discipline to all CARMs. Kendy for the State.*

The computer must be trying to answer. It wouldn't be able to find *Discipline* with its navigational instruments severed. He sent, *Beam to pressure suit 26.*

"Something just started humming in my head."

"Everything's fine, Rather." The signal was being relayed. He sent, *Status?*

CARM #2 sent its tale of woe. Massive malfunctions. Internal sensors out, external sensors out, motors not responding, life support systems not responding, navigational systems not responding, power low. Records intact. Presiding officer: Admiral Robar Henling . . .

Kendy sent, *Copy.*

All?

Y.

The Admiralty Library accepted the Copy program, hummed thoughtfully, and began beaming its records.

That would take twenty-six minutes. Kendy activated the course change he'd worked out hours ago. *Discipline* was about to use a good deal of fuel. It would hold him over the Lagrange Point for long enough.

The records arrived in reverse order. Common practice. Recent records were likely to be more urgent. Kendy dipped into the flow. The control board had seen little while housed in the Library room. There were glimpses of the sky during ceremonies. Records of births, deaths, marriages. It had been dismounted in year 130 SM. The CARM hadn't crashed; it had deteriorated over the years, helped by deteriorating maintenance . . .

He couldn't spare attention with so much else going on. The drive ran smoothly. Tank less than a fifth full. *Discipline* accelerated, drive swinging out to point at the stars, to hold the ship close above the L4 point against its own spin. Rather was exploring the room; his pulse and breath rate were rapid.

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Bored and anxious. Jeffer, crouched above CARM #6's control board, was in similar shape. The neudar view of Admiralty Headquarters showed fog-spots clumping, then moving in two streams toward the Library.

Something was happening. Little lights brightened and dimmed on the carm control panel. His helmet hummed. It wasn't particularly entertaining. Rather said, "Kendy?"

"It's working, Rather. Don't bother me."

"Jeffer?"

"Here."

"Kendy's busy and happy."

"You've got more than two hours—about a half a day before Mickl's on duty. Nobody should bother you."

"I'm hungry enough to eat a sword-bird, and may the best entity win."

"Did everything go all right?"

"I'm *scared*, Jeffer. I may never get over being scared. Why on Earth are we doing—"

The door opened.

Rather saw a silver suit pointing a crossbow a few degrees wide of his navel. The insignia was familiar. He and Booce had spent half a day painting them on the silver suit, from pictures taken by the silver suit's camera.

The door—

Rather's radio spoke in his helmet. "I know who you are," said the voice he'd been trying to imitate. "What I want to know is why. Let's—"

Rather leapt straight at Wayne Mickl, and fired a burst from his jets for extra force. He couldn't let the door close.

The silver man swung his crossbow aside and braced to kick, too slowly. He'd expected the jump but not the jets. Rather slammed into him. Mickl bounced away. Rather struck the jamb and, spinning, was through the door and out into a horde of Navy crew.

"I know who you are—" Wayne Mickl's voice, pressure suit #5, radio frequency badly distorted by time, and Kendy locked on it. He beamed instructions to the Library: *record the view through pressure suit #5 cameras, one snap per ten minutes, henceforth.*

It was a nice bonus. He welcomed it, because he was about to lose Rather Citizen. A dozen Navy crew in the fish-eye view, unknown numbers out of camera range—

Jeffer bellowed, "Rather! What's going on?"

"Wayne Mickl came back. Can't talk."

Kendy sent, "Get outside if you can, Rather. Mickl's jets aren't fueled."

"I've got the whole treefeeding Navy here!" They were hesitating, but they wouldn't for long. "They'll swarm all over me like honey hornets— Hey!" Rather's hands came in view holding a bag; ripped it open and flung it. The corridor became vague and golden.

Wayne Mickl could pull the cable! Was he still in the Library? CARM #2 had a hundred years of records to go . . . a solid block of data was running now, data that must have been beamed long ago by *Discipline* itself. He wouldn't want to read that in full, not if it was records of the mutiny. He'd spot-check.

The other pressure suit emerged from the Library and jumped to join the fight. *Good!*

Rather's camera view shot down the

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corridor, through dust and bodies. Navy crew grabbed at him, clung . . . and let go. It began to look as if he might make it.

What was running through *Discipline*'s receivers was a message from the State, from Earth.

Nothing in his own memory matched. Kendy pulled it and ran it. It was brief.

Rather jumped down the corridor, arms raised to block the men who blocked his path. Impacts slowed him. A burst from the jets compensated. Somebody was riding him, legs around his hips . . . a man impacted heavily against his helmet, slid across his chest, and was gone.

The silver man jumped him. The man who clung to Rather took the force of impact. They tumbled. Rather reached the door, kicked, swung himself around the jamb and was out in the sky. A burst of jets took him clear.

He paused then.

The silver man emerged and, twenty meters away and receding, stopped to put on his wings. Navy crew emerged behind him. Two flailed; they had no wings at all. The third couldn't get his on. Fringe spores must have reached their brains.

That left only the silver man.

Rather grinned. He put on his own wings and kicked away strongly. "Kendy? Jeffer? Are you watching?"

"Jeffer here. I can't get Kendy. He may be out of range."

"Well, watch. This is going to be good."

Mickl was catching up.

Rather's radio sounded calm and a bit supercilious. "Rather Citizen, you can't escape. Your wings are the right color, but they're not Navy wings. You know I don't want to hurt you. I had the chance to kill you and I didn't. But the crossbow is all I have, and it will penetrate—make holes in a Navy pressure suit. There's a hole in one of our suits because one of our Guardians turned mutineer once."

"Don't answer," Jeffer said. "He's guessing. Don't give him a chance to test it."

Mickl was meters behind him, but the drugged Navy crew were nearly out of sight. Rather pulled his wings loose, pointed his feet at the silver man, and fired his jets.

He was head-down to the Dark. Mickl was kicking hard, falling rapidly behind. A scream of shock or frustration burst in Rather's ears; he found the volume control and turned it down fast.

The Dark was around him. He couldn't see the other silver man; he couldn't see the Market.

Jeffer spoke in his helmet; a tiny squeak until Rather turned the volume back up. ". . . due to rendezvous. I've got a ship moving north out of the Dark. Stand by . . . There's a dark blob bigger than the cabin—"

"That's *Logbearer*. They've got their mud."

"Turn seventy degrees clockwise from where you were pointed and, oh, ten degrees north. Make your burn."

Rather obeyed. Jeffer counted off twenty seconds: seven breaths. The Dark thinned.

"We've got to get rid of the silver suit," Jeffer said.

"No." I'm the Silver Man!

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"I don't mean feed it to the tree! I mean don't have it when *Logbearer* gets home."

"How?"

"I don't know, and Kendy isn't answering. I don't even know what course he's on now."

"What if I don't go back? You can pick me up with the carm."

"Sure, and what does Wayne Mickl say to the Serjents? You've got to face him and lie."

Rather could see the Market far behind him. Was he in view of Navy instruments? But they'd have to find him, and he'd changed direction.

The deep voice of Wayne Mickl was small and full of the chattering sound of distance. "Rather Citizen, I will wait for you at Serjent House."

"I heard that," Jeffer said. "I've spotted you. Can you see Voy? Sixty-five degrees east, burn for five seconds. Zero north, there's no point in getting higher. You'll both be back in the Dark before you meet."

"Jeffer? Why don't you come get the silver suit?"

". . . Stet. Here I come."

Rather himself had spotted *Logbearer* now, above the plane of the Dark, foreshortened and trailing steam.

Jeffer said, "I'm on my way, but it'll take me nearly a day. If you just ditch the suit it'll fall back into the Dark."

"It's doing that now. You'll have to find it somehow. I've got an idea."

Rather flew through the Dark. He was using wings. There couldn't be much left of his fuel.

He glimpsed a man-shape through the murk.

Carlot. When he opened his helmet she kissed him breathlessly. "I thought I'd never see you again! Did you do it?"

"Yeah. All of it, but the Captain-Guardian knows, or thinks he does."

She talked while she helped him out of the suit. "Raym got too much of the fringe. He's in the cabin getting through the hangover. Debby's with him. She'll keep him quiet. We've got our mud and four tons of walnut cushion. Two Dark sharks tried to open us up. Debby took them. Rather, I'd hate to have her mad at *me*. We've got the meat, and I'll show you tooth scars on the wood—"

"I hope they were big. I'm *hungry*." He was out. He closed up the suit, leaving the helmet open. "Jeffer?"

"Here. I'm above your position."

"I'm doing it." He closed the helmet. He turned the pressure dial high and the temperature low. The suit grew rigid. "Now I want to start a fire."

"In the Dark that won't be easy."

"Help me. That . . . fisher-jungle, I guess it was." He indicated a mass of dry brush with white things taking root in it. "Help me push the legs in."

They pushed the suit into the decaying fisher-jungle. The branches still had some strength. Rather got a good grip, then closed a jet key with his toe. Flame blasted through the rotting fisher-jungle; the suit tried to escape. He let the jet run for several breaths before he turned it off.

"Jeffer should find that okay," he said. He was guessing and he knew it.

"Then *tell* me! What happened?"

He told her some of it while they searched out *Logbearer*. The rest would wait. Clave and Debby would have to wait to hear the tale, since Raym could

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not be allowed to. And Rather would have his chance to eat and sleep. He was exhausted.

Chapter Twenty-One: The Silver Suit

From the Library cassettes, year 200 SM:

> Citizens may never enter the Library Room. Citizens will be given access to the Library only through officers, and then only on certain dates. . . . On these days the Library will remain available, with a Programmer on duty, until all citizens have had opportunity to ask their questions; though some questions will certainly be unanswerable. . . .

They stopped twice; once at the Market, to let Raym off with half his pay in hand, and once at a pond, to refuel.

Belmy's log was very slowly turning end-for-end. A thread of steam poured from above the tuft. As Carlot made her final burn to bring *Logbearer* to rest near the midpoint, *Woodsman* cast loose and moved toward them.

Serjent House was just visible to antispinward: west. Rather tried not to think about the dot visible alongside it. He welcomed the delay.

Debby said, "I'd like to get this over with—"

Clave shook her by the ankle. "Wrong! We went into the Dark for mud, and we're back get rid of it. We don't know of anything urgent. We're in no hurry at all."

Carlot shouted from where she and Rather worked the rocket. "Stet! Treefodder, they always make *us* wait!"

They had it all figured out. But copter plants were launching their seeds in Rather's belly.

Woodsman eased alongside. Hilar and Raff Belmy flew toward *Logbearer*. "You'll like Raff," Carlot whispered. "*Act* like you like Raff."

"It's all right. I'd make babies with him if it'd make you happy . . . or get me away from the Navy."

Hilar introduced his son. (Treefodder, but they were big!) Raff smiled much and said little. He was shy for an adult, Rather thought. He stared at the tree-dwellers, but his eyes seemed to slide aside from Rather's.

The teapot passed. Carlot asked, "How are you doing with the log?"

Hilar shrugged. "No burl yet." The others laughed. "Give it time. We have some spin. I don't think we want to overdo it. We've splashed a pond against the trunk; that gives us a water flow. How are you planning to deliver the mud?"

"I . . . hadn't thought past just bringing it here."

"Raff and I talked it over—"

Raff spoke. "Dad always says keep it simple. We'll just impact it against the tree, lee side, two, three klomters above the tuft. There's already water running down to the treemouth. Let it carry the mud too. Easy, steady delivery system."

He can talk when it's about something real, Rather thought. "Have you done a lot of logging?"

Raff's head bobbed. "I spend more than half my life in the outer sky. Sometimes I wondered what living in a tree would be like."

They were getting used to that question. Clave said, "I miss it myself.

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Well, you grow up shorter and stronger. Cooking's easier. Hunting's different: the wind *throws* the prey at you. . . ."

Rather tuned it out. The dot next to Serjent House must be a Navy ship. He felt their long-sight devices on him. What the Navy saw must look puzzling. Let them wonder: he had an explanation both interesting and innocent.

His attention snapped back when Hilar said, "Booce has been making deals. I expect he'll pay back the loan well before crossyear."

Carlot asked, "Has the Navy bought the metal yet?"

"No. In fact, something's upsetting the Navy. I haven't heard a rumor I can believe, but . . . stay alert, Carlot. You know you've got visitors?"

"We can see them. Hilar, Raff, it's time to deliver our cargo."

It took a day and a fraction, and was entirely straightforward. *Logbearer* burned toward the turning tree. Her crew dismounted the spokes that braced the web that supported the mud. Mud and lines and wooden spokes smacked the trunk hard enough to stick. Water flow was already carving a runnel in the mud as *Logbearer* accelerated away. They'd be back to collect the beams and lines after they were washed clean.

Gyrefalcon was not moored; it floated free a hundred meters from Serjent House. Two men working on the hull did not return Clave's cheerful wave. Rather recognized one as Petty Wheeler. They watched fixedly while *Logbearer*'s crew swarmed out and set about the business of mooring their ship.

Rather looked around the common room while they tethered their wings. One fast look and then he'd have to react.

No teapot. Not a social occasion. Booce Serjent looked angry and unhappy. Bosun Sectry Murphy started to jump toward Rather, then pulled herself back. Three long-limbed Navy men were stationed around the walls, and a fourth: silver suit, helmet thrown back, bearded dwarf-face within. Wayne Mickl.

Rather let himself break into a delighted grin. It was surprisingly easy. He wanted to reassure Sectry; he was glad to see her. He let his eyes flick from Sectry to Wayne Mickl to Sectry again. He blurted, "Am I in?"

Sectry flashed from unhappy to angry. Wayne Mickl broke into delighted laughter. "Very *good!* But, Rather, there just aren't enough dwarves to make it work. Take him."

Two of the Navy crew were on him. They pulled him loose from his handhold, set him spinning in the air. He caught glimpses of them rebounding from walls. Then one had wrapped his arms and legs around Rather's lower ribs from behind, and the other had a foot in Rather's crotch and Rather's two ankles in his hands, stretching his legs straight.

There was a wrestling trick. Jill had shown him, in the brief period when she was stronger than he was. You wrapped your arms or legs around your opponent's ribs and tightened them. Your opponent couldn't inhale. Presently he would faint.

Rather had used it on others afterward, and been punished for it. Most

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of the children were smaller than he was. Jilly wasn't, but she didn't have the strength of a dwarf after they both got older. Rather had been taught not to fight. He still got angry sometimes, but he learned to control it. Sometimes he wrestled with adults. He generally lost.

The man behind him (call him Navy #1) was letting him breathe, but shallowly. The other (Navy #2) wasn't kicking Rather's seeds into his belly; but he could. Rather held the red rage in check. "Booce?"

Booce answered the implied question. "You tell me. Where have you *been?*"

"The Dark. We've delivered Hilar's mud. We've got some walnut cushion and—"

"The Navy went through this house like a whirlwind. I told them about the sporing fringe in the concrete. I was about to show them a hiding place I made in the door. I think they'd *rather* chop my house apart, and I get the distinct impression that it's all your fault—"

"Shut it, Booce," Mickl said. "Rather, what did you think you were coming home to?"

Anger made his thoughts murky, but he'd rehearsed this part in his mind. "I thought . . . I saw Sectry and I saw you. I thought the Captain-Guardian had come personally to tell me I was in. The Navy. You know. But—"

"You must know that an officer wouldn't care that much about a new inductee."

"Well, you're *here* and . . . someone told me you're very eager to put another dwarf in the Guardian slot. What *are* you doing here, Captain-Guardian?"

"It's a mistake!" Sectry burst out.

Mickl didn't shout; he projected his voice over hers. The walls shivered to it. "Let me tell you something about mistakes. There's—"

"No, allow me." Rather reached for the foot in his crotch with both hands. He had it before the leg could snap straight, and he twisted. His rib cage closed. He stopped breathing and kept twisting. The leg buckled; Navy #2 was pulled close; he loosed Rather's ankle and Rather kicked him twice under the jaw. Now his hands were free to pull the constricting arms apart and over his head and down. Torsion pulled the legs free too, and he could breathe.

Navy #2 kicked at Rather with his good leg. Rather caught it on his foot. Reaction separated them: Navy #2 was headed toward a wall. There was blood on his mouth. Rather pulled the other's arms around behind him. They came, not easily, and Rather kept pulling until he had pulled Navy #1's shoulder from its socket.

Clave had a rib lock on the third man.

Rather pushed Navy #1 away. The man turned in the air, moaning, his arm at a crooked angle.

Navy #2 had reached the wall. He jumped. They traded blows: Rather put his heel in the other's midsection, but a fist smacked solidly into the side of Rather's neck. Short arms and legs had cost Rather more than one match.

Again the blows had thrown them apart. Rather's ears buzzed; lights flared in his eyes. He was too far from the walls. He waited . . . but Navy #2 was curled in a tight ball. When a wall touched him he stayed there, winded, resting.

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Wayne Mickl was pointing a crossbow at Rather. "Cut it. I'll shoot you someplace nonlethal. You too, Jonthan. Stay there. You, the tree man, let go of Doheen!"

Clave released Navy #3. Doheen was unconscious.

Panting, elated, Rather said, "Stet. But mistakes are something . . . *somebody* pays for, and that's what . . . the word is for. Or am I going too fast for you?"

"Yes. Pause a minute. J—What is it *now?*"

The men in the doorway both looked surprised. One was a Navy crewman. He had Raym Wilby in a rib lock. "Captain-Guardian, this one flew up like he was coming to the house. Then he saw the ship and turned around and flew away. The Petty and me chased him down."

"Who are you?"Mickl demanded.

Raym only gaped. Carlot said, "It's Raym Wilby. He guided us into the Dark."

"Wilby, what were you flying from?"

"I . . . I just don't like N-Navy."

"Stet. Jonthan, wipe your face, then take Wilby into the storage room. Ask him about the trip. Be polite."

Doheen blinked; his eyes opened. The man from the ship took charge of Navy #1, the man with the dislocated arm. Rather heard him yell as his shoulder popped into place. Jonthan (Navy #2) wiped blood from his mouth with a cloth, then took Wayne Mickl by the elbow and towed him away. Rather noticed for the first time that Sectry had a crossbow too. It was pointed at Clave.

Mickl ignored it all. "Now, Rather, tell me about a pressure suit that looks like mine. Don't forget the crossbow."

Rather was still panting a little. He took a moment more than he needed. "Pressure suit? Booce told me. You've got three. Nine crew to use them, but you're short of dwarves." Which ought to be a pun, he thought; but he'd irritated Mickl enough without that.

"A fourth pressure suit invaded Headquarters fifteen days ago. You were in it."

Rather stared. "No, I wasn't. Fifteen days! I was in the Dark getting mud. Is that what this is all about?"

"Rather, it's your bad luck that I'm interested in dwarves. I know where every dwarf in the Admiralty is right now. There are twelve. Ten are in the Navy. One is eighteen years old. He'll be a Petty soon. Sectry already is. The rest are Guardians. There's a Dark diver's boy, but his brain was thick with spores before he could grow a beard. And there's you."

"And another pressure suit."

"Yes. I want it."

Rather wiped sweat from his face. He was thinking as carefully as if he were innocent. The trick was not to know anything he shouldn't. This seemed safe: "Captain-Guardian, if a pressure suit got into the Admiralty without your knowing it, maybe there was a dwarf in it."

Mickl didn't answer. Rather said, "S—the Bosun and I are about the same size, but I think you're bigger. How big was that fourth suit? Would I even fit?" He was stuttering a little; he had to think every word through first. How clearly had Mickl seen the silver suit? It always looked bigger than the occupant. "Maybe

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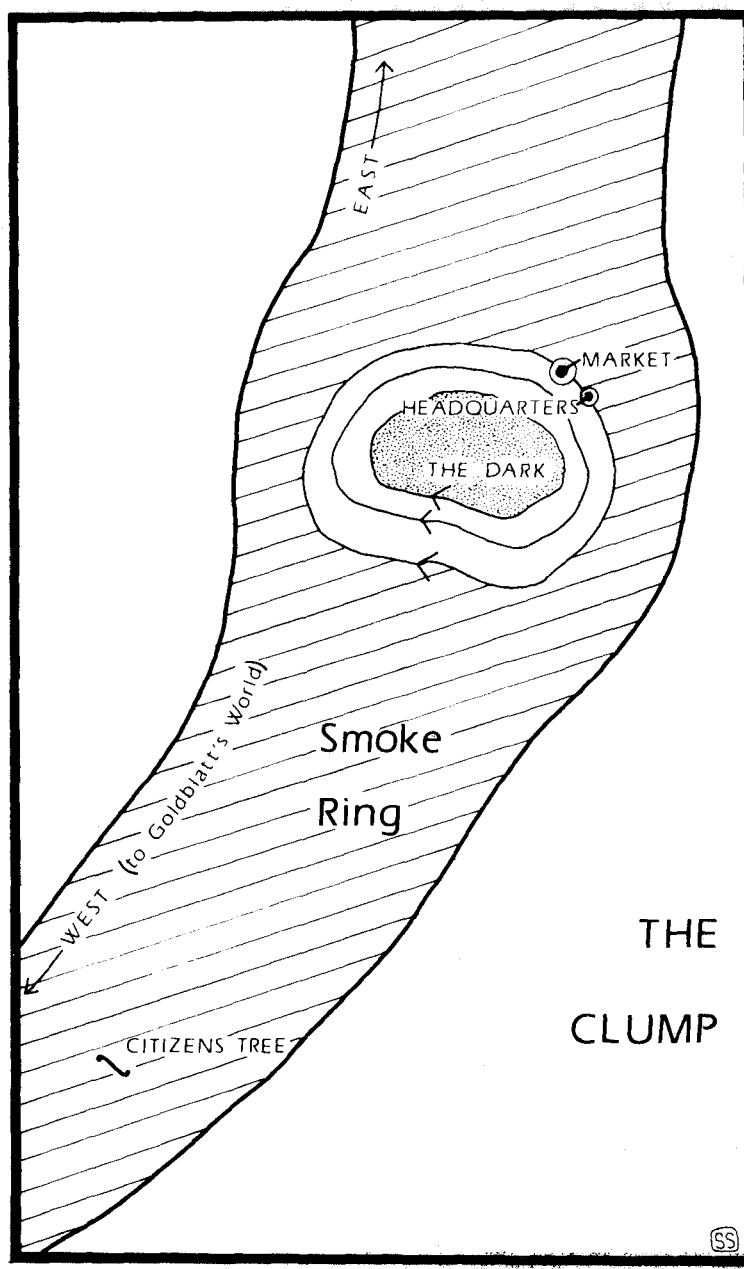

Diagram by Shelly Shapiro

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it's smaller yet. Maybe it's so small that it'll fit in places you wouldn't look, a closet in a happyfeet ship—"

"Why that?"

"Happyfeet tried to rob us before we got here. They don't care much about laws. Isn't there a Lupoff ship in dock?"

"True enough, but a closet is silly. He'd suffocate."

"Somewhere else, then." *There's air in the silver suit. Am I supposed to know that? What else am I not supposed to know?* "What really happened? What is it you think I did?"

"You entered Headquarters in an unregistered pressure suit painted like mine. You got into the Library. You got rid of the Guardian. We haven't been able to find out what you did there, or whether you got what you wanted, but Voice was running when you left. When I came in you scattered sporing fringe throughout Headquarters and got away." Mickl's throat worked, and Rather saw how close he was to uncontrolled rage. "I went after you. I couldn't catch you."

"Um . . . that doesn't make sense. Booce told me never to try to outfly Navy. The wings are different—"

Mickl slashed the air with his arm. "The suit outflew me! This isn't just another pressure suit. You'd be in enough trouble if it was only that. We've *got* to have this suit. It's special."

"How?"

"Classified, you little fungus!" Wayne Mickl closed his eyes. He pulled air in through his nose until his lungs were full, then let it all out. Calmly he said, "Booce, show me this hiding place."

Booce showed him. *We wouldn't have been told this either,* Rather thought. Secrets!

Mickl closed his helmet. When he peered into the compartment, light blazed from the forehead. He studied the interior at length. "Ingenious."

"Maybe not. It weakened the door." Booce pointed out the hole. Mickl nodded.

Jonthan was back. A long bruise was forming on his jaw. His glance at Rather seemed disinterested. He and the dwarf officer conferred in low voices. They disappeared toward the storage room.

That left only Navy #3, Doheen. He and Clave were holding a staring contest, Clave smiling, the other poker-faced.

Booce said carefully, "Rather, there's something you should know. You're trying to tell the Captain-Guardian that you're probably innocent. It's not enough."

Rather had thought things were going well. "Raym was with us. He'd have to believe Raym was lying too. Raym doesn't have the brains."

"No, of course not. Mickl believes you now." A quick glance at Doheen, who reacted with something like a shrug. "But just in case he's wrong, he'll stop *Logbearer* from ever leaving the Admiralty, because we might be smuggling that fourth suit. He'll ruin me financially, in case I might say something to save myself. He'll hound you. It'll never be over."

"Then—" *What'll I do? There can't be a way to convince Mickl I'm innocent. I'm guilty!*

Admiralty pressure suits don't have working jets. No fuel. There's a suit

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with jets, somewhere, and Mickl wants it. He'll never settle for less.

Give him the silver suit? He'd know we're guilty then.

If I could—Ah. He had something.

I can't ask Booce. Doheen's listening, and Booce doesn't know what happened anyway. The others—

Fate and air currents had put Rather near Sectry. He moved closer. She moved the crossbow aside for him. Her face was hard to read.

"I shouldn't have left," he said.

"Why didn't you wait?"

"They tell me the Navy takes forever to do anything. I couldn't just hang around twitching, and we needed the mud."

Their voices had dropped. She said, "I was here. I turned down a flight, but I can't do that twice running. You left me for *mud?*"

It was a miserable thing to have to admit, but it was better than the truth. He nodded.

"Rather, nobody makes decisions when he's on fringe. So tell me, am I too strange? Am I too old?"

"My mother's older than my father. I like strange. I'm in the Clump because I like strange. Sectry, I don't regret anything I said or did." Which was not quite the truth. *Secrets*— "Hilar Belmy is trying to grow a burl tree."

She said, "That never works."

"Well, he's trying something new. Booce bought a piece of the tree. And he owes us."

"So it's not just mud, it's money. All right, Rather. I can understand money."

"That's more than I do. It's power, but it doesn't make you an officer. Are there un-rich officers?"

Her lips twitched. "They marry rich citizens. Their children are officers. The number of officers goes up. One day we'll all be officers."

"Why does Wayne Mickl want that suit so much? I'd think it would be the other way around—"

"It's bad for the Admiralty if happyfeet hold old science. I think Wayne's almost given up on taking his Captain's seat. The pressure suit is as much power as he'll ever have, and he takes his responsibilities—"

They were back: Wayne Mickl and Raym Wilby and Jonthan. Raym was unwontedly quiet. Mickl said, "And what were you discussing with the Bosun?"

Sectry was flustered; Rather answered first. "I was suggesting that if you did have a fourth pressure suit, you'd need twelve dwarves to man them."

Sectry tried to cover her laugh with her hands. Booce laughed outright. Doheen's mouth was rigidly straight. Mickl was about to explode.

And Rather had learned little from Sectry, but it might be enough. *Go for Gold.* Before Mickl could speak, he asked, "Does it fly better than your suits?"

Mickl's face didn't change. "Yes. How did you know that?"

"You said it outflew you. Besides, I heard something once."

"You'll tell me."

"Privately, if you don't mind, Captain-Guardian."

They took the kitchen. Mickl said, "That fringe-adled Dark diver makes you a poor witness."

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"I don't know anything about your Chairman's Court."

"You'll see a court soon enough. Talk to me, boy."

"I don't know anything about your mutineer pressure suit either—"

"Then—"

"I once heard that there's a way to make little holes on a pressure suit spray fire. Then it can fly without wings."

"Go on."

"Maybe I can find a man who can do it. He doesn't have a pressure suit, so he's never tried it."

"Take me to him."

"They don't deal with Navy. They don't even come into the Admiralty." Rather visualized a mysterious happy-feet tribe, isolated and distrustful. "They sent copsiks once. The Scientists don't come themselves."

"Give me a name."

He picked one he could remember. "Seekers."

"There's no such tribe."

Rather shrugged. "What happens is, you give me your pressure suit—"

Mickl laughed.

"I take it somewhere." Payment? Not money; the Seekers might not use money. "I take fringe too, maybe twenty kilos. I take tools. I bring the suit back. They keep the fringe and the tools. Maybe the jets work and maybe they don't."

"Let me tell you why I can't give you my pressure suit," Mickl said gently." "First, it belongs to the Admiralty. Second, it alternates among three Guardians. My triad would notice. Third, turning a pressure suit over to savages would certainly be judged as mutiny, especially since—fourth—you might not bring it back. Stet?"

"Not stet. Let me think."

"While you're thinking . . . This mysterious tribe, did they ever have a pressure suit to practice on?"

"They say they did—"

"Could they have gotten it working again?"

This was taking Rather into empty sky. Treefodder! Maybe it was lost, or stolen, or—

"*Talk* to me!"

"I was trying to remember. They threw it away."

"*What?*"

"It killed three citizens."

"How?"

"The . . . silver suit was only for one who was worthy. One day the old dwarf died while he was using it. Three dwarves wrestled for it—"

"That sounds like too many dwarves, Rather."

It did. "I saw two myself, and I never got inside the jungle. I guess Seekers get more dwarves."

". . . Go on."

"The winner put the suit on and died. The one who lost to him put it on and died. The last one was a woman. She started to get into it, but while the—" Rather patted his skull. "—this part was still open she said she heard the voice of Kendy the Checker. Nobody else could hear it. They got scared and dumped it and moved to another part of the sky."

"Sounds like the air went bad. What then?"

"That's when they found the Admiralty. They say one of your ships tried to rob them—"

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"Nonsense."

"We say treefodder. They say you did." It *might* have happened in the past: Navy robbing savages—

Wayne Mickl was looking disgusted. He said, "It's possible. A ship low on provisions . . . this isn't helping."

"Wait. You three who trade your suit off. Are you always on duty at Headquarters?"

"No, of course not. Why?"

Rather took a deep breath. "Your fourth point: of course we'll bring the suit back. Not all of us will go. You'll keep friends of mine to answer for it if the suit doesn't come back.

"Your third point: maybe it's mutiny if you lose your chance at a pressure suit that can fly without wings, especially if it belongs to the Admiralty, which was your first point, and especially if you could get *three!* So let's work on your second point. Can you get the Admiralty's permission?"

"Admiral Robar Henling would rather give up his seeds. At his age it wouldn—No. Just no."

He *was* getting somewhere. He had Mickl's attention. Think! "Will your, uh, triad try to track down that flying pressure suit?"

"We will. We are!"

"You can go anywhere if you think it's the right direction, stet? You're Guardians. One of you is an officer. Nobody'll ask. Am I completely off the track?"

". . . Not yet."

"So off you go, tracking rumors of a fourth pressure suit. Maybe you find it. You close in. But there's a dwarf in it, and he sees you coming and flies away laughing. What he doesn't know is that your triad was working without a pressure suit for awhile. Then it came back. Now off goes the bandit dwarf, but he's doomed, because your suit flies too and he doesn't know it!"

Mickl's grin was not quite a pleasant sight. "Were you a Teller, where you came from?"

Rather knew exactly what he meant. "Our Teller was Merril till she died. These days everyone does some telling. Captain-Guardian, I'm trying to help. I'll bring the suit back whether it works or not."

"But would your Seekers give it back?" Mickl sighed. "I don't blame you for attacking my men, and I won't charge you. We'll leave it at that for the moment. This isn't finished, Rather."

The civilians watched the Navy people fly toward their rocket. Sectry was trailing; and when he saw her look back, Rather snatched his wings from the door and jumped after her.

She stayed in the air while he strapped his wings on. A voice spoke from the Navy ship's cabin; she answered. Then she kicked away to avoid the rocket's exhaust. She did not fly back toward Serjent House.

The Navy rocket departed.

Rather reached her. He didn't have breath to speak. She said, "You're involved in something."

He shrugged helplessly.

"I don't know what's going on, but I don't want any part of it. I've decided I don't want to live in a tree, either."

Rather had his breath back. He said, "We're the right size."

She shook her head violently. Teardrops flew. "Didn't Wayne tell you

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how many dwarves there are in the Admiralty? Rather, it was a good offer. Nobody makes real decisions when she's on fringe. I'm sorry."

"So am I." His tongue was in knots and his thoughts were scrambled. *The Scientist and the Checker, they caused this, they sent me into Headquarters! Would it be different if they hadn't? Did I mean it, that offer? How will Carlot feel about this? Or Jill?*

"I do want to see you again. After this is over, if it's ever over. You'll be going back to the tree, won't you? You won't like it here, not with the Captain-Guardian on your tail!" She didn't wait for his answer. "Well, sooner or later there'll be a mission to Citizens Tree, and I'll be on it. I hope this is all cleared up by then."

She flapped spinward, toward Headquarters or the Market. He called after her. "We have a rocket—"

"No. Thanks. I'll go on foot." She kept kicking. Rather turned back to Serjent House. He was going to have to do some fast talking . . . again.

Chapter Twenty-Two: Loop

Where had it all gone wrong? A message may become garbled across fifty-two light years of distance and interstellar dust. But this was simple, unambiguous, and *repeated—*

From the CARM #2 cassettes, recorded year 76 SM day 1412:

> To *Discipline*, year 1435 State. Retrieve your crew and continue your mission.
>
> —Frank Shibano, for the State

—as if he were a wayward computer in need of reprogramming. Arrival date: Feb., 26, 1487 State. Recorded by CARM #2 sixty-one Earth days later.

He'd accomplished his mission! Why this?

He had attempted to follow his new orders. Of eight CARMs he had sent into the Smoke Ring, he located three. The rest must have been destroyed, or worn out, or their sending systems turned off.

From CARM #2 he had learned of the death of Claire Dalton. Claire had died at one hundred and thirty-eight, less than two months before the message arrived. No other survivors were known to the CARMs. Many deathdates had been recorded.

Amazing that Claire had lived so long.

There had been a mutiny. Kendy had stored it in CARM #2's computer before he erased it from his own memory. Sharls Davis Kendy had mutinied against his crew. Fool, not to have seen that! Their descendants used *mutineer* as an insult!

He'd made an irretrievable mistake. But how? His reasoning was straight. His orders were unambiguous . . . weren't they?

> 1) . . . You will visit each of these stars in turn. Other targets may be added. . . . The State expects to settle these worlds, spreading humanity among variable environments, against dangers that might affect only Sol system.
>
> 2) . . . The human species is not invulnerable. There is finite risk that the crew of any interstellar spacecraft may become the entire human race. They and their genes are in your custody. CLASSIFIED.

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3) Your tertiary mission is to explore . . .

—Carther, for the State

How could it be clearer?

Kendy knew how the dinosaurs had died. The State had explored the ringed black giant planet that periodically hurled flurries of comets into the solar system. The State could stop comets now. The solar system was tamed. Ten planets were better than one; cities and industrial sites on thirty moons and hundreds of asteroids were better than none; but the lesson of the dinosaurs remained. Planets are fragile.

Earthlike worlds had been found in the habitable zones of nearby stars. Green life had emerged on two. At *Discipline*'s departure they were in the process of final terraforming. On twenty-six worlds, poisonous air resembling Earth's primordial reducing atmosphere had been seeded with tailored algae. In a thousand years some would be ready for further attention. The seeder ramship program had been running since seven hundred years before Kendy's birth.

And *Discipline* had found a habitable non-planet!

Humanity was to be spread as widely as possible.

The dangers here were not a planet's dangers. The Smoke Ring and its enveloping gas torus were dense enough to protect Earthly life from radiation from the old neutron star, and from other radiation too. Radiation sources were normal throughout the universe. A supernova explosion near Sol . . . a passage of Sol and its companion stars through a region of star-creation . . . a catastrophe in the galactic core . . . events known and unknown could cause havoc through Sol system *and* all nearby systems. But none could harm the Smoke Ring!

His own message to Earth, sent in the year 1382 State, was long and detailed. CARM #2 had the record:

Sharls Davis Kendy had abandoned his crew as they explored the Smoke Ring. Three who remained aboard had been invited to take what they needed from *Discipline* and join them. He had never given reasons; his secondary mission was CLASSIFIED. He had shut down systems aboard *Discipline* in a pattern that forced them to the CARMs.

Ah, that explained something: those three had not loved cats. Pure coincidence.

Then, the message from Earth. *Put it back the way it was.*

How? His crew was dead!

Faced with conflicting orders, he could not function at all. He would be locked in a loop of reinforcing guilt. Kendy had sequestered all data relating to the mutiny and beamed it to CARMs #2, #6, and #7, then erased it all from memory.

How had he gone wrong? Could the message itself have been garbled? Through 200 repetitions?

To *Discipline*, year 1435 State. Retrieve your crew and continue your mission.

—Frank Shibano, for the State

No explanations, no elaborations. He'd been reprogrammed like a wayward computer., *Why?* He'd accomplished his mission!

Was the message genuine? Check the dates:

Kendy's own mission report, sent 1382 State.

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Message from the State dated fifty-two point two Earth years later. He was fifty-two point one light years from Earth. This Shibano had not lingered over his decision, but . . . it checked.

—Arrived fifty-two point one years after *that*. Check.

. . . Odd. Why would the State expect *any* crew to remain alive? That Claire had survived was partly due to low gravity, good conservative health habits (her mind was that of an elderly corpsicle), youth (via the body of some bright, healthy criminal) and luck. The rest must have been dead decades earlier (and their descendants called him murderer and mutineer and damaged machine.)

Shibano for the State. Kendy found it difficult to consider Shibano as separate from the State, but . . . what could Shibano have been thinking? Rescue after one hundred and four years: it was insane.

Perhaps the State's medical resources had improved? Times change. Every generation of mankind has sought longer lives. Thousand-year lifespans might have become common. . . .

Speculative.

But times change. Goals change. Kendy's route here had been circuitous. The State that had given Kendy his orders was four hundred and fifty-five years old when he reached the Smoke Ring. Five hundred and seven when Shibano spoke. Five hundred and fifty-nine when his message arrived.

Kendy did not normally question orders. Conflicting orders could throw him into a loop. But he had been round and round this loop, while some voiceless subsystem sought desperately for a way out.

Somewhere in a pattern of magnetic fields there was a change of state . . . and Kendy the man would have laughed. A change of State, yes. Sharls Davis Kendy's State was a thousand years in the past. Dead. Somehow he must serve anyway. His own goals had been spelled out in detail; he would serve those.

Humankind was to settle varied environments. So be it. What was his present situation?

The receding Smoke Ring covered forty degrees of sky. His mind had been following a loop for just under two months! He'd missed the final stages of the explosion on Levoy's Star, the foray into the Admiralty might have disintegrated by now. . .

To work. *Discipline*'s drive had shut down without his attention. Good! He still had fuel.

He started the drive warming. His orbit was a comet's, highly eccentric. Equations ran through his mind . . . fire a short burst at aphelion. Shed some velocity by aerobraking, by dipping into the gas torus around the Smoke Ring, twice. Use Goldblatt's World as a gravity sling, save a few cupfuls of deuterium that way . . . .

Glowing in direct sunlight, the Clump was green-and-white chaos in *Logbearer's* steam trail. Clave felt good: loose and free, cruising through an uncluttered sky.

Rather crawled out of the angular cabin. His head was metal and glass. "The suit's too big, but I can wear the helmet."

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Clave smiled at the sight. "Getting anything?"

"Getting. . . ? No. Jeffer hasn't called. Maybe he can't call this suit. I tried Kendy too."

"Too bad." Clave had been watching a distant brownish smudge of vegetation. Now he shouted aft. "Carlot? Could that be a fisher-jungle?"

"Be with you in twelve breaths." Carlot finished what she was doing to the motor and crawled to them over the cabin. "Where?"

Clave's toes jabbed east and out.

"I don't see the root . . . right, that's what it is. I'd better turn off the motor or we'll go past. Rather?"

Rather followed her aft. Clave stayed at the bow while they worked the motor. Presently the tide behind him went away.

Closer now, the fisher-jungle looked dead enough. Brown foliage and bare branchlets. Tufts and patches of vivid green: parasitical growths. The fisher root was half extended, like a dead man's hand with three scarlet fingernails. He looked for the carm . . . and found a man flapping toward him.

Jeffer pulled himself aboard, panting. "Moor to the root. Treefodder, I'm glad to see you, but what are you *doing* here? Is everyone here?" He looked over the edge of cabin and shouted, "Hello, Carlot! Rather, what . . . is that a pressure suit helmet?"

"Yes. The rest of it's inside."

They told it in tandem while they moored *Logbearer*.

"I never did quite know if the Captain-Guardian believed me," Rather said, "but he left Serjent House without taking any copsiks—"

"The Navy watched us for the next forty, fifty days," Clave said. "We weren't doing anything peculiar. Booce sold wood and hired people to cut it. We bought more seeds and some tools and stuff. We're carrying all that. Mickl kept coming around, interrupting us, trying to get Rather to tell him more about Seekers—"

"I tried not to talk too much. I built up a picture of these Seekers in my mind, and maybe I got it across. Secretive. Not very many of 'em. Too many Scientists, maybe half a dozen. They've got a cassette and reader but they don't show it to outsiders. They threw away their silver suit, but they've got records on how to maintain it. And they swear to kill anyone who tells their secrets. The citizen who told me disappeared. He was high on fringe and I was just a kid, but I had a better memory than most kids . . . That part's true anyway," Rather said. "I haven't told Mickl all of this."

"Dangerous," Jeffer said. "You'll have Mickl desperate to meet them."

"Not if I read him right. Scientist, you know the story now, and you can back me up. Give him details I didn't."

Clave asked, "Jeffer, did Kendy get the records he wanted?"

"I haven't heard from him."

"If we're lucky the treefeeder never will call back. Anyway, we must have looked innocent enough. We never did anything odd because we didn't know anything. So. Twenty days ago three dwarves pulled up to *Logbearer* in a Navy rocket. Mickl and another man and a woman, all the same size. Weird. They gave us the pressure suit and went away. We're supposed to get the jets

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going and pay off the Seekers. Would you like ten years' supply of fringe?"

"No. You'd better leave it here if you're supposed to."

They carried the suit and helmet into the dead foliage. Rather and Carlot set to moving their cargo while they looked about.

Entropy and parasites had eaten a deep cavity into the fisher-jungle's dead trunk. The carm was there, and Jeffer's camp: rocks for a fireplace, a rack of poles for smoking meat, a midden a decent distance away. Jeffer had made a third wing for himself, a prudent move for a man alone. From the blackened look of it he'd been using it to fan his fire.

Jeffer had the pressure suit splayed like a bird's flayed skin. "Rather, did you try it?"

"It's too big for me. —And the air feed doesn't work. I got the panel open. A little wheel isn't connecting to anything, and there's a spoke with nothing on it."

Jeffer grinned. "I see."

Rather laughed. "Mickl doesn't want the Seekers stealing his silver suit! If they try it they'll find out nobody's worthy!"

"I'll refuel it. No guarantee the jets still work."

"Well, if they do work, I get the impression that Booce will get a decent offer for the Wart. Mickl never actually said so."

"Three pressure suits?"

Clave said, "Stet. We may have to do this twice more. And they're searching Dark and sky for a fourth pressure suit. They must be looking hard at where *Logbearer* went. You may want to move the carm."

Carlot arrived pushing the last of the cargo: not seeds, but tools. "You're going to love this, Scientist." She separated something out.

Jeffer took with glad cries. "A pump! Wonderful! The carm's low on water, and I *hate* the way I filled it last time. Can I keep it?"

"Stet. We're supposed to bribe the Seekers with it. Here, this is a bellows from the Market. You anchor one end. It's easier."

"Nice. Can you stay for a couple of sleeps? I've got food and—"

"Lonely?"

It showed in his face. "You know it."

"We've got food you never tasted. Dark fungus and earthlife. You'll love it."

Their exotic dinner was nothing unusual for Rather, not any longer. What made it fun was watching Jeffer react.

He talked while he ate. "I had some trouble getting the silver suit. I found it okay, but it was right in the fire. I had to get the bow up against it and push it out along with a kilton of burning goo. I just wonder how many Admiralty citizens saw me."

"The stories won't match," Clave said. "In sixty days it won't matter at all. I've been thinking. We'll burn the fringe here. If a Navy ship comes they'll find that the Seekers had a hell of a party and then went away."

"Good. I'll have to take the carm someplace you can find it—"

"No. You find us. *Logbearer* will be returning to Citizens Tree in due course,

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maybe another thirty days. Keep watch. Pick us up well outside the Clump."

"Another fifty days of this? Treefodder. And I never even saw the treefeeding Clump."

"We'll leave you most of our food," Clave said.

Carlot carefully wasn't looking at Rather. "I'll be bringing a guest. Raff Belmy and I'll be married as soon as we get back to the Admiralty. I want to bring him back to the tree. What he tells his father is up to him, but he'll have at least a quarter-year to think about it."

"So you decided," Rather said. He felt he had almost gotten used to the loss.

"I'm like you. I'm tired of secrets."

"There's a plant here that grows good foliage," Jeffer offered. "Dessert."

Carlot tossed an orange sphere at him.

Jeffer's acting like a happy eight year old. Rather thought as he tethered himself into a foliage patch for sleep. *Being alone out here must be rough on him. Maybe all adults stay children someplace in their heads. . . .*

"Rather?"

"Yuh. Carlot?"

She wriggled under the lines and was alongside him. Rather opened his mouth and closed it again. Then he said, "I don't like lying to you."

"What now?"

"I was going to not say, 'What would Raff think?' "

She didn't move away. Presently she said, "You don't understand us."

"Nope."

"We like to spread the genes around. Nobody talks about it in public, but you hear. A man and a woman get engaged. They make babies together. Sixty, seventy days later, they get married. Maybe the first kid looks like the rest and maybe he doesn't."

"But *why?*"

"It's the last chance. See, I'm going to marry Raff, but there are men I turned down. They're not going to just vanish. I wasn't with Raff *all* those sleeps I was away. Raff's been seeing friends too, I don't know who. Rather, it's just different. The officers say it's good. They talk about gene drift."

"Okay."

"What Raff thinks about it is, he'd rather not know. I never did wonder what Jill would think."

"We never made promises."

"Sure. But who else is there? There's nobody anywhere near her age in the tuft. Just you."

"I suppose. I wish I could have told her I was leaving."

She said nothing. Rather couldn't drop it. "I wish I could tell her it was worth it. You never wanted that raid on the Library. You were right. If Kendy's really gone, then why did it happen? The Navy'll never stop being suspicious of us, and we didn't learn anything, and I can't even tell Jill about the raid because I can't tell her about Kendy."

She stirred. "You don't want me?"

"Sure I want you. Every sleep we're here, I want you. I wanted you for keeps."

"You can't have that. When we marry, that's the end of that. Understand?"

"Stet."

Kendy had run the records from CARMs #2 and #6 over and over. He'd

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built up a sub-library of sorts under RESOURCES, LOCAL USAGE.

Here: Citizens Tree was firing mud to make a cookpot. Here: firing the laundry vat. Both had been recorded by the silver suit as it moved unharmed through the fire. One clip every ten minutes.

Here: curing the lines from the spaghetti jungle. Mark the Silver Man unharmed in the smoke.

Here: the elevator in Citizens Tree. Here: recorded years earlier by Klance the Scientist: the London Tree elevator, run with stationary bicycles.

Here: CARM #6 changing the integral tree's orbit. Here: *Logbearer* moving another tree.

Here: Rather collecting honey. Booce's *voice explaining that it was usually done* with handmade armor. Here: a set of hornet armor made to show the Navy customs collectors, lest they seek for such and find the silver suit instead.

The natives used materials from *Discipline* when they had it. When they didn't, they made do. They were doing very well without Kendy.

Discipline was making its second aerobraking pass, ass-backward through the gas torus. The cone of the fusion drive approached fusion temperatures. That was hardly a danger, but the plasma streaming back along the hull had to be watched.

Velocity, Smoke Ring median: 11 kps. Velocity at Kendy's distance: 3 kps. *Discipline*'s relative velocity: 20 kps and falling. *Discipline* reached perihelion and began to rise, embedded in hot plasma. The animals were frantic. Kendy couldn't spare attention for them. Nothing had melted on his first pass . . . but the gas ahead of him thickened as he rose, because Goldblatt's World was ahead.

Visual: a raging, endless storm the size of Neptune. Neudar: a core the size of two-and-a-half Earths spun once every seven hours, carrying the storm around with it, until the atmospheric envelope trailed off into the Smoke Ring. Instruments: impacting plasma increased in temperature and density; velocity decreased. The ship was surviving. There'd been the risk that he would have to blow hydrogen ahead of him for cooling.

Goldblatt's World passed below, warping the ship's path into something nearer a circle. Now the plasma density dropped fast.

Fifteen minutes of that was enough excitement for any computer program. In an hour he'd be over the Admiralty and out of the gas torus. He'd make his last short burn then. It would hold him near the Admiralty for a good half hour.

Discipline would be glowing bright enough to see, if anyone looked in just the right direction. That might or might not be good. Kendy had taken his time returning. His long range plans were in tatters and he didn't know what to do about it.

Chapter Twenty-Three: Beginnings

From the Citizens Tree cassettes:

Year 384, day 2250. Booce recorded our holdings before we left. He's appalled that we never asked. Bad businesspersons, he calls us. We don't usually bother to spell out who owns what in Citizens Tree. It drives Booce crazy.

We spent a lot on seeds and food and widgets, but we still have credit

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—imaginary money—in some vague amount that depends on what Booce actually gets for the wood and the metal. We'll learn that when, and if, we return to the Admiralty.

—Jeffer the Scientist

The lift cage dropped. It was crowded with eight people and several bags from the carm. Lawri and Gavving, Scientist and Chairman Pro Tem, seemed distinctly uncomfortable. It wasn't hard to guess why. Raff Belmy was uncomfortable too. Carlot clung tight to his arm, possessively, protectively.

"I had some trouble finding the tree," Jeffer said.

"Your problem," Gavving answered. "After all, you took the silver suit. How were we supposed to tell you where we were?"

"Yeah, but you moved the tree, didn't you? That thing next to the lift, is that what I think it is?"

"Yes. Lawri's doing, mostly."

"Hah. Scientist, I thought you'd be twiddling your toes waiting for me to come home."

"We found ways to occupy ourselves, Scientist." Lawri's pregnancy was growing conspicuous. The formality between her and her husband did not seem unfriendly.

Gavving said, "I hope you brought something to make us look good."

The rest of them laughed; but Clave said, "Trouble?"

"Treefodder, yes, trouble! I'd have flown to a new tree if I'd been *sure* they'd let me have wings. One thing, the children are on our side. They've been crazy with waiting to see what you bring back. And Minya stuck with me."

"She did? Good," said Clave.

"She did, in public."

Clave reached into a bag. He sliced an apple in half and passed it to Gavving and Lawri. They bit, distrustfully, and continued eating. "That'll do it," Gavving said.

"Fine. Here. Don't eat the hull." He'd cut an orange into quarters.

They gnawed the insides out of the oranges. Lawri chewed and swallowed a bite from the peel, but did not take another. Gavving said, "Yeah!"

"We've got seeds," Clave said. "This and a lot of other earthlife. We'll plant them in the out tuft."

Faces like a field of flowers below the falling cage. Two meteor-trails of golden blond hair: Jill next to Anthon, a meter shorter than her father, both scanning the faces in the lift cage. Rather knew when Jill's eyes met his, but her face didn't change.

The cage thumped into its housing. Children piled out of the treadmill, and Mark with them. Everyone in Citizens Tree was here.

They looked short: a field of dwarves in which Anthony and the Serjent women stood out as normal. Rather had become used to giants. Children and some adults crowded around the cage. Jill and Anthon hung back, not quite hostile, but suspending judgment. Mark had that look too.

For all these hundreds of days Rather had wondered what the tribe would think of his mutiny. He'd almost managed to forget that he had never told Jill, *could not* have told her that he was going to leave the tree.

His mothers were crowding close

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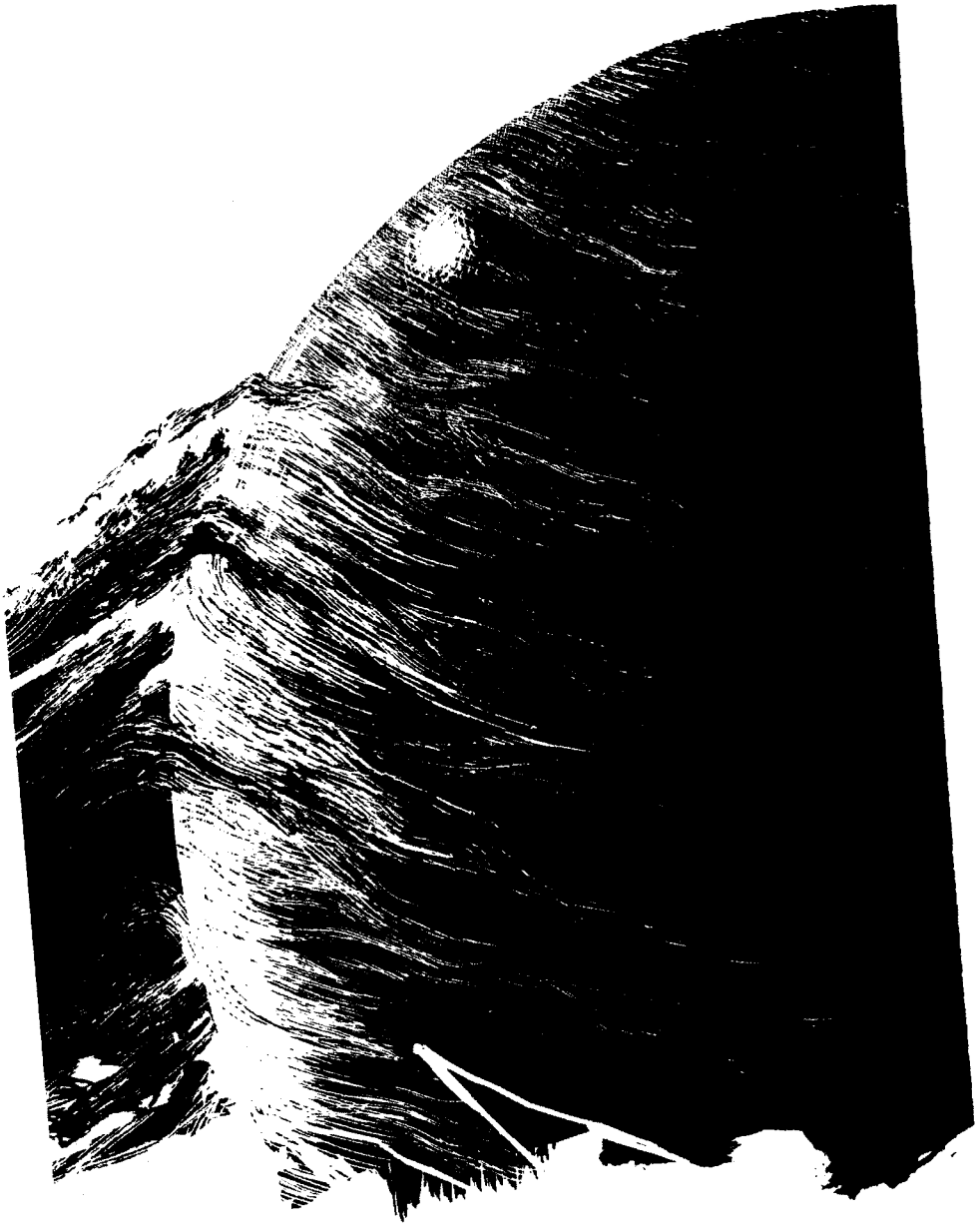

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around the lift, and Karilly and Ryllin with them. The Serjent women hugged Carlot, then Carlot's new husband. Karilly hung back a little. She was conspicuously carrying a guest. Raff beamed like sunlight at seeing people he knew. They fell into rapid conversation, moving away, taking Karilly with them. "Damn, but I missed oranges . . . Booce had to stay? I'm not surprised, but . . ."

Karilly was silent.

Clave folded his wives into his arms and forced apples on them.

Anthony slapped an orange from Debby's hand. Rather heard: "You took this Admiralty man aboard the *carm?*" before his First Mother picked him up to hug him.

"You treefeeding fool," Minya whispered. "You fool mutineer, you. Drillbits in your brains, both of you, you and your father. He never stopped wishing he'd gone too. Are you all right?"

"I'm in good shape. Mostly." She pulled back to look into his face. He tried to look earnest. "First Mother, I'm allergic to dry, thin air. Not enough sleep does it too. It's like knives in the eyes. I go blind. It lasts for hours."

She started laughing. She said, "I'm sorry, I'm sorry," and hugged him hard, still laughing. There were tears in her eyes. She put him down and saw him smiling slyly. She said, "It'll never happen again. We'll keep the tree where the air's thick. You'd better go talk to Jill."

"Why? What's wrong?"

"Talk to her first. Then I think—"

Jeffer shouted for attention. "I here present Raff Belmy. Raff and Carlot are married by Admiralty law. The record is in the cassettes."

Over the heads of his brothers and sisters, Rather saw the judging-look fade from Jill's face. She moved forward at last. Rather said, "Harry, can you give me some privacy? Take them along?"

Harry said, "Oh. Sure." Somehow he got his siblings moving away before Jill reached him.

The judging-look was back. She said, "Rather. How are you?"

"Fine. Nobody made me a copsik. I didn't get killed. Jill, I wanted to tell you."

"Were you afraid I'd run tell my father?"

"If I wasn't, the rest of us would have been. I couldn't, Jill."

He saw her reject that. She asked, "What was it like?"

"I'll be a lot of days telling you that!" And suddenly it was a pain in him, that he couldn't tell her about the raid, ever.

"What's wrong now?"

"Nothing," he lied. "I was remembering how close I came to joining the Admiralty Navy. I got out of it though. Jill, dinner has to be something special. Is there time to cook some of this earthlife?"

"Couple of days yet."

"I'll show you what to do." Take the kids too? He'd thought he wanted to be alone with Jill, but now he knew he didn't. "Harry! Gorey! Bring those bags to the cookpot."

The Admiralty slid west below him. Kendy began his burn, then turned to his instruments.

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Neudar and the telescope array caught Admiralty Headquarters as it emerged from behind the Dark. The Library didn't respond. It must be turned off. CARM #6 was nowhere in evidence. No pressure suit responded to his query.

Sharls Davis Kendy had made more than one mistake. For half a thousand years he had been frantic to begin guiding his citizens in the Smoke Ring. Now he could begin, and now he almost knew how. Opportunities would come.

A part of his attention scanned his growing file on RESOURCES. LOCAL USAGE:

Debby described Half Hand's kitchen for Jeffer's benefit.

Clave carried the helmet on a slow trip through Serjent House.

The camera viewpoint spun erratically through a cloud of children. Children had knocked the helmet off its usual perch at the lift, then played with it like a basketball. Kendy viewed it as a series of stills. Corridor openings, the water trap, the communal cooking area, children laughing as they bounded in slow arcs.

A series of angular Clump houses, wildly various.

Mark's hut in various stages of construction. The silver suit had been housed there for a time.

Abruptly the CARM #2 control board came to life. Kendy sent his signal. Records came back: stills of various bored Guardians in their shared pressure suits, culminating in (present time) six jungle-giant men in a half-circle around the control board, wearing anxious faces and spotless new uniforms. These must be officers; and now Kendy had their insignia.

The signal disintegrated with distance.

He rounded forty degrees of Smoke Ring before he made contact with CARM #6.

The vehicle was in its wooden dock at the midpoint of Citizens Tree. It was empty of citizens and cargo. That was *Logbearer* next to the lift cage, and some smaller structure next to that. Kendy "stared": he enlarged the image and examined it in detail.

They'd built a steam rocket.

They didn't have a metal pipe or sikenwire, so they'd used ceramics. Fired mud! The laundry vat was part of it!

Records: the CARM on its way home. *Logbearer* was strapped along the hull. Booce was missing. Rather was present(!) The jungle giant stranger matched the still of Hilar Belmy's son.

Raff Belmy's medical readings, originally ominous, settled down over passing days. Carlot must have helped to calm him down. Rather was being abnormally polite to both, and keeping his distance. The two spent considerable time out of sight aboard *Logbearer*.

Records: moving toward the Citizens Tree midpoint. The ceramic rocket returned ahead of the CARM. It puffed toward the in tuft, pushing a huge glob of black mud, and passed out of range.

Records: "Year 384, day 2400, Jeffer speaking as Scientist. Carm and *Logbearer* are both docked at Citizens Tree. This will be my last log entry until Kendy calls.

"Kendy, for your information, Rather got out of Headquarters safely. We refueled the jets on an Admiralty pressure suit and returned it. Captain-Guardian

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Mickl could have had the other suits refueled too, but he never brought them. Now he's got a pressure suit with jets. We gave him some time to play, and then we told him what to do when they run out of fuel.

"We've had no further trouble. Booce got a good offer on the metal. The Navy was carving it up when we left.

"Rather suggests that Mickl wants the flying suit for himself. It's something even the Admiral doesn't have. He's got a secret now, and we know it, and he'll need us to keep it flying. That gives us a certain edge with the Captain-Guardian if we ever want to exploit it.

"We have some wealth and some influence in the Admiralty. We got it without your help. We do not appreciate your abandoning Rather in the middle of the raid.

"I've spent as much time waiting for your call as I care to. I'll be back from time to time. If you haven't called by the crossyear, which is three hundred and ninety-one days from now, I will turn Voice off."

Nobody was near the CARM. The lift wasn't running.

The CARM drifted out of range. Kendy scanned the far arc of the Smoke Ring out of habit; he had never seen signs of industrial activity there.

The Admiralty flowed before him. The Library had been turned off again.

Their ancestors hadn't listened to him either. They'd turned off the Voice subsystems; they'd cut the fibers that allowed Kendy to fly a CARM by remote. He'd been completely cut off for half a thousand years. As he was now.

Rather was scrubbing his teeth and thinking about breakfast when the Silver Man came into the bach hut. He spit and said, "Mark?"

"Who else?" Mark threw back his helmet. The silver suit was filthy and stank of smoke. "I tried that. I felt silly."

"Sure, silly. Mark, I saw their teeth. The older Admiralty citizens still have half their teeth! I bet Ryllin and Mishael have been scrubbing their teeth all along." Rather remembered that this man wasn't his father . . . and didn't know it, and had a legitimate grievance. All in a rush he said, "I stole it. We thought we needed it and we did. It was *right* to go. Treefodder, Mark, you're from a bigger tree! Don't you feel cramped here?"

"Fifteen years I've felt cramped. Relax. You brought back some wonderful things. You brought back the carm and the suit and you didn't ruin the suit."

"You looked mad enough to kill when we came down."

"That was three good dinners ago. I never thought I'd taste potatoes again. I know a better way to cook them."

"You forgive me? Mark, I'm really glad."

"What are my choices? Sure I forgive you. We're firing the new laundry pot."

"Is it that late? I slept like a rock. Needed it too. These first few sleeps I just lay wondering why one of the walls was pushing against me."

"I've spent some sleepless nights here myself," Mark said. "It's lonely in the bach hut. We built it too big. Big enough for the next crop of men."

"Maybe that's it."

"Have you talked to Jill?"

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"Minya asked me that. We've talked. Why?"

"Yeah. Well." Mark sometimes had trouble finding words. "Citizens Tree is strange. None of us grew up the way you did. There are adults and children and a big gap in between, so you couldn't tell much from just watching older children grow up. Maybe there are things we should have said—"

"I know about sex, if that's what you mean. . . . Maybe I need to know more. Two women have told me to feed the tree. It hurts. What should you have told me about that?"

Mark whistled. "You started young. Well, someone could have said, 'There's only one suitable mate for you and there's only one for Jill in this whole tuft, and she thinks she owns you, and maybe she's right.' "

Rather let that percolate through his head. "Jill wants to make babies with me? Did she tell you that, or are you guessing?"

"I'm guessing. All I *know* is, when Instant Chairman Gavving told us you'd gone off with all the wealth of Citizens Tree, Jill was madder than I was, and that took some doing. She wanted you thrown into the sky with no wings. A hundred sleeps later she was sure you'd all be killed and she couldn't see for crying."

"I'll go see her. Where is she?"

"Go easy, stet? *You* know you can find other mates. Jill doesn't."

"I don't either. Sectry wants no part of me—" He couldn't say why. Secrets. "And Carlot married someone else. You can't imagine how bad that was. All the way home, Carlot and Raff. They spent most of their time in *Log-bearer*. It wasn't any better when I couldn't see them."

Mark said, "When nobody wants you in the first place, that's worse. Trust me."

"Mark, I've gotten very good at lying. I'm trying to stop."

"Good. Go talk to Jill."

"Where is she?"

"Everybody's watching us fire the laundry vat except Jill. I've got to go back and see if anything needs doing. Try the miz hut. Then the commons."

The deep voice hailed him as he entered. "Hello, Jeffer the Scientist. This is Kendy."

Shouldn't that have been *Kendy for the State?* Jeffer said, "Uh huh. You missed all the excitement."

"Not all. A large Navy ship is moving toward your position, They'll reach you in eighty standard days."

Jeffer took a moment to absorb the shock. He should have known. It wasn't over; it never would be. There was no going back from the Clump expedition. No going back from *knowing* about the Admiralty.

He pulled himself forward to the control board. "That gives us some time to talk."

The square, hard face in the bow window had always lacked expression. It said, "A bad thing happened to me, Jeffer. I learned too much about myself. There was no way I could communicate until now."

"Lie to me, Kendy. Say there was something wrong with Voice."

Kendy said, "The glitch was in myself. I think I have it fixed. Machines go bad, Jeffer. I left you a file under

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HISTORY. It's selected records from the settling of the Smoke Ring. It explains some of what went wrong. Play it after I'm out of range."

"Can you tell me about it?"

"No."

"Your timing was lousy. We thought you'd left Rather for treefodder. If you ever—"

"I can't talk about it. It hurts my mind. Damage might be permanent. Do you seek vengeance against me?"

The trouble was that Kendy looked and sounded as calm as death. Kendy never showed anger, nor relief, love, pain. It was hard to believe he was hurting . . . yet he was *not* a man. Maybe. Maybe.

Jeffer said, "Well, we got home. I assume you got most of it from the log. The earthlife food stopped most of the arguments. Now all the reunited couples are busy making babies. The arguments haven't gone away, though. They're just simmering. It won't help if there's a Navy ship coming."

"It's coming. I couldn't resolve details of design. There's alcohol in the exhaust, and it's coming from the Clump. Definitely Navy. What have you done with the seeds?"

"Seeds? We'll plant them in the out tuft. Mark's talking about building an extension to the lift before anything gets ripe enough to pick."

"Cut some foliage so the sunlight can reach the plants. I can show you how to use water flow to move the lifts with less effort. You haven't mentioned the fired mud rocket."

"That's nice, isn't it? We don't need the Admiralty's treefeeding pipes."

"You don't need me," Kendy said. He knew the risk he was taking. It was acceptable. "I've been looking at records. Most of what can be done with materials from *Discipline*, can also be done with Smoke Ring resources. Lifts, housing, clothing, food, domestic animals. Now rockets. The Admiralty even has a heliograph."

"No, we don't need you," Jeffer said, "but I never thought you'd know it."

"A bad thing happened to me. I don't trust my judgment any more. My intention has always been to make a civilization in the Smoke Ring, modeled on the State that shaped your ancestors. The Smoke Ring will never be that. How can I make a State in a place where I can't even make maps?"

"Would we even like your State? Skip it. What do we do about that ship? I hope Sectry Murphy's aboard. We'll get some notion of what they want if Rather talks to her—"

"Hide the carm in another tree. Tear out the dock too, or put the ceramic rocket there. Show them that. It's not advanced, but it doesn't need starstuff resources. It may impress them. Keep the carm manned. There are two ways you might need it—"

"I won't burn them!"

"One way, then. You can't ignore the Admiralty. You'd really like to join as officers. You may have to show them the carm before they'll listen to *that*. Demand officer status, but they may settle for giving it to just the Chairman and Scientist—"

Jeffer laughed. "For a man who doesn't trust his own judgment, you certainly—"

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"I think fast. I plan fast. I make mistakes."

"Anything else?"

"Mark might want to join the Navy. Sound him out. See if the Navy personnel might want him. I gather they don't like older recruits, but Mark was trained in London Tree. Karilly may benefit from going back. Is she still mute?"

"Yes, but she's also pregnant and happy. I'm not sure I want to fiddle."

"I'm almost out of range. Back in two days. The code is HISTORY. Tell nobody of what you are about to learn."

"K—"

"Unless in your judgment it would be beneficial."

Kendy had *never* talked like this. "Stet."

The face faded. Jeffer didn't move for some time. Finally he tapped the white button. "Prikazyvat Voice."

"Hello, Jeffer the Scientist."

"Link to the pressure suit."

"Done."

"This is Jeffer calling anyone. Anyone home?"

"Hello? Scientist?" It was Jill's voice.

"I want to talk to my wife."

"I'll get her. She's on the branch."

That would take most of a day. Jeffer started the HISTORY file and listened to it all the way through. Then he started it again.

Lawri climbed in through the airlock. "I didn't have anyone but Rather and Jill for a treadmill team. Everybody else is on the branch. Now, what's all the excitement, Scientist?"

"Prikazyvat Voice. Run HISTORY."

Dead voices spoke. *Discipline*'s crew reported the discovery of a weird cosmological anamoly. Some of what followed was familiar from the cassettes. Some was entirely cryptic.

"How long have you had this?" Lawri demanded.

"Kendy only just filed it. I . . . I've been in contact with him since before we left for the Clump."

Lawri was coldly angry. "That was mutiny! How could you not trust *me?*"

"I'm trusting you now. Listen."

They heard a highly formalized quarrel. Some of the participants argued for settling the Smoke Ring; some were for moving on to an unnamed destination. Kendy spoke in favor of staying, then tried to terminate the argument. It continued.

There were parts of a broadcast from *Discipline* to Earth: it had been decided that they would settle the Smoke Ring environment.

There was a message from Earth: *Retrieve your crew.*

"And that's it. Kendy got conflicting orders," Jeffer said. "It tangles his mind. He can't go for new orders because Earth is too far away, and he can't make up his own mind because he's a machine, and he can't talk about it because it drives him nuts. If that's all true, he must be close to crazy all the time. The question is, what do we do now?"

Lawri said, "We can play this through the silver suit. Play it for the whole tribe. Tell everyone."

"It'll start some fights."

"Feed the—"

He rode her down. "There's a Navy ship coming. The fights'll have to be

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over when it gets here. A hundred days."

"Stet. Play it at dinner."

". . . Stet."

The situation was ideal in its way. They were together, but they couldn't talk. There were only the two of them to run the lift. It took all their breath. Jill scrambled over the rungs, keeping up with him. Her tuftberry-red tunic was dark with sweat at chest and armpits. Her hair was a golden halo, as interesting and as beautiful as Sectry's scarlet.

After the cages passed each other they let the treadmill carry them round and round. Then it was time to throw their weight on the brake. The lower cage settled. Rather and Jill dropped into soft foliage and panted.

Rather found his breath . . . and found Jill watching him solemnly.

He said briskly (he hoped), "Mark says you own me. This is a thought that never crossed my mind."

"He says that?"

"Yes. He says I own you too. What do you think?"

"I think Mark doesn't have the right to say it."

He was an arm's length away. He couldn't read her expression. He said, "It's not just Mark. My parents—all four, or all three and a half, and everyone else, including you, Jill. You all seem to know just where I fit and what I'm supposed to do for the rest of my life."

"Well, you don't take orders worth treefodder." He was not sure that was a smile. "What's bothering you, Rather? You came home on purpose. You're on the cookpot because you volunteered to cook the earthlife. You're the Teller because you've got stories and you like telling them. It gets you off treemouth duty."

"I like all of that. But I'm told where to sleep and I'm told who to marry, and everyone looked at me funny till I changed back into tuftberry red, and the whole damn tribe sent me to talk to you."

"Okay. Talk."

"Rather doesn't take orders worth treefodder. You talk. Are you unsatisfied with me?"

"You went into the sky and left me behind."

"I did."

"Is that over now? Are you back for keeps?"

"No."

"Why not?"

Rather sighed. "I like coming home. I like seeing new things too. Some of us will have to go back to the Admiralty anyway, Jill. Ryllin wants to join Booce. Then there's a whole *sky* out there! Lawri says our gene pool is too little. Fine. We'll go find some other trees and get mates there."

"Should I do that?"

Running endlessly up the treadmill, he'd had some time to think. "Maybe. Or you could marry me, but I'll take trips, and you'd have to put up with that—"

She flared. "You'd be making babies with every woman who talks funny!"

That was manifestly unfair. Rather let it pass. "Or you could come with me."

"Stet."

"That quick? Are you sure?"

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"Sure."

This was working out better than he'd hoped. "Did you work on that new rocket?"

"No. Why?"

He hadn't thought it all the way through after all. "We've got time. In a couple of years a dozen kids will be ready to find mates. That's when we'll start visiting other trees—"

"I see it. I'd have to know the rocket inside out, how to steer it, how to fix anything that goes wrong, because I'm the oldest."

"You and the rest of the crew too. Can you fly?"

"Sure. Oh, all right, I don't do much flying. Rather?"

"Here."

"You seem to have a very good idea of where I fit and what I'm supposed to do."

It *was* a smile. "Sorry."

"Maybe this is what being married is like. Anyway . . . I'll go on the next trip. That'll tell us everything we need to know. Whether I can stand it. Whether citizens can stand my company aboard a rocket. Whether I'm any good. Whether I want a mate from somewhere else. Whether you do."

"Next trip will be the Admiralty."

"Stet," said Jill. She stood up. "Let's go flying."

"There's nobody to run the lift for us."

"Off the branch," said Jill. "Fly to the midpoint. Surprise Lawri."

It would do that! Rather began to understand that Jill would go where he would, and try to beat him there too. "We'll have to fly more than thirty klomters out. Can you handle it?"

"Sure. We'll go off the branch and put wings on afterward. Otherwise someone'll stop us. Come on."

Kendy had assembled the HISTORY file with some care. It was unaltered records, but it gave the distinct impression that *Discipline*'s crew had themselves decided to settle the Smoke Ring.

The population of the Smoke Ring was between two and three thousand (Kendy included children.) By his original orders, Kendy must consider that they might now be the entire human race. The temptation to meddle was very strong.

He would not shape them. They were shaping themselves, and they were doing it well. For agonizing moments he had even considered severing communications entirely.

But he had things to teach them!

The Library was off when he passed the Admiralty. It wouldn't stay that way, though. Day 2791 was the midpoint of the crossyear, three hundred and fifty-odd days away. If Kendy knew his citizens, they would celebrate, and the Library would be involved. Perhaps he could reach Wayne Mickl. Kendy had a handle of sorts on the Captain-Guardian.

Meanwhile a Navy ship was moving on Citizens Tree. He'd see what terms he could arrange.

Plenty of time. Kendy waited. ■

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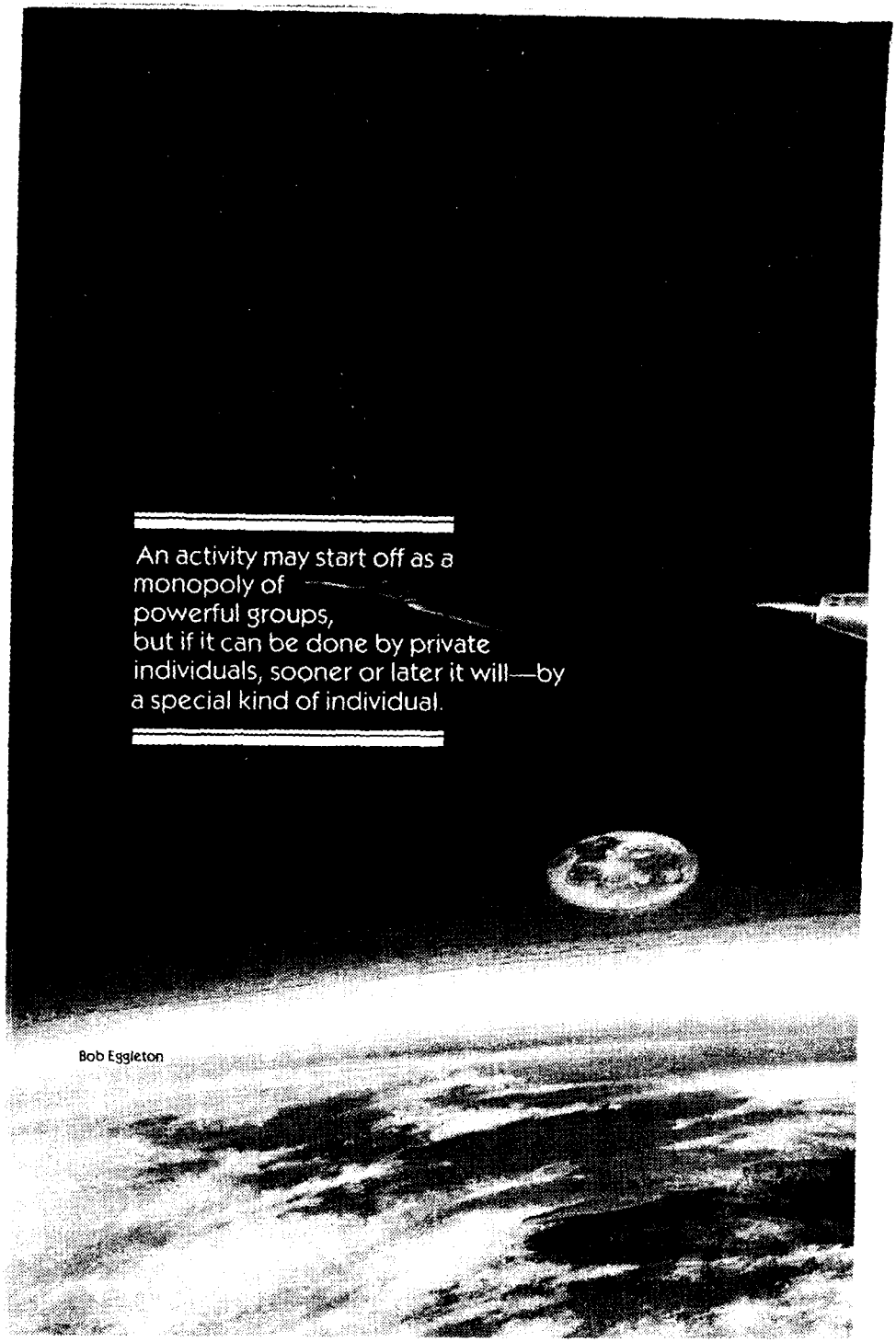
An activity may start off as a
monopoly of
powerful groups,
but if it can be done by private
individuals, sooner or later it will—by
a special kind of individual.
Bob Eggleton

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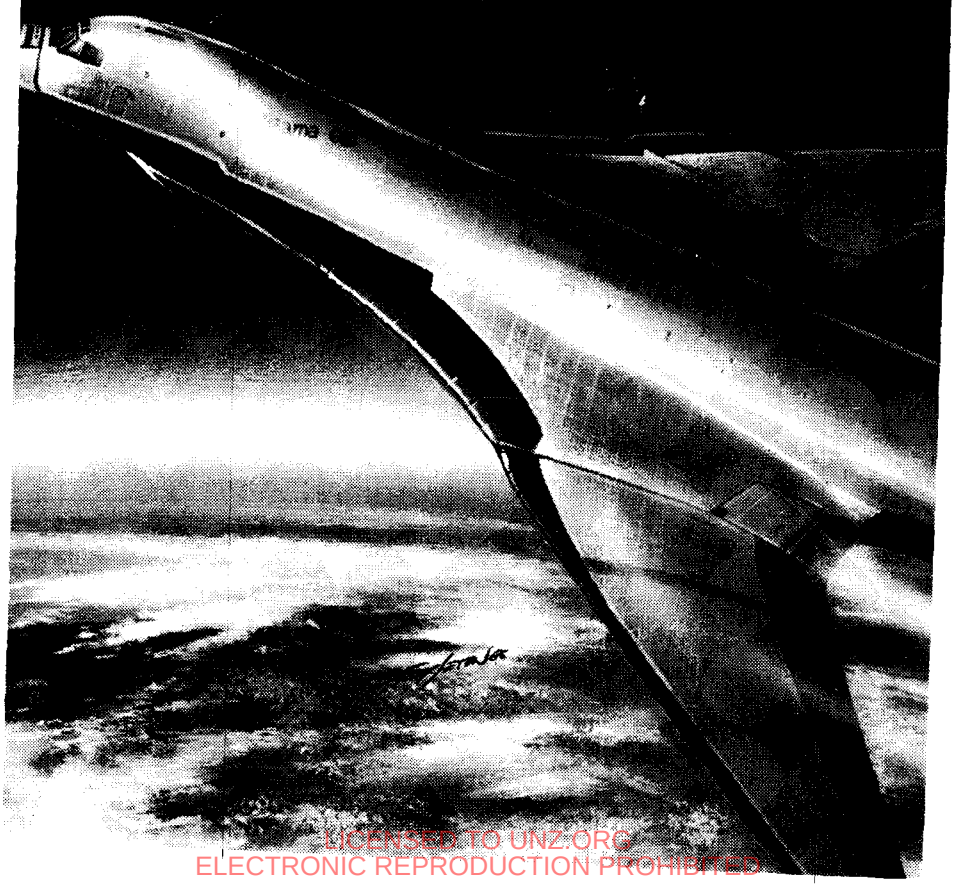
Eric Vinicoff

INDEPENDENTS



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Pops squatted on the *'Bama Gal*'s port wing, running the sprayer back and forth, adding another ablative layer. He was stripped down to cutoffs, sneakers, and an Aussie hat. His sun-cooked hide stretched taut over a long lean skeleton. A Colt assault rifle lay within reach on the shiny white aluminum composite.

He looked around. The fierce afternoon sun bleached everything and stirred shimmers in the air. The *'Bama Gal* was parked in front of the hangar which was their temporary home, dwarfing the cargo planes and cropdusters of the airport's low-rent district. The runways reached out to the brown grass and scrub of an undernourished veldt. Past the passenger terminal he could make out the "skyline" of Kigali, the capital city of Rwanda, Africa. Rwanda was one of the world's poorest countries, and the airport looked it.

"Hey, Pops, how you coming up here?" Sean's liver-spotted scalp appeared where a ladder was propped against the wing, followed lethargically by the rest of him. The fat around his middle squirmed like a sack of hydraulic fluid. His coveralls were soaked with sweat and so stained that their original color was anyone's guess.

"Give it another ten minutes," Pops drawled. "You finished?"

Sean nodded. "I managed to adapt the gas generator Chadda swiped from that junker in Manila, but the ATR's really need a full shop overhaul. The scramjets ought to be pulled period. Thermo-fatigue."

"You talk like we had a maintenance budget. Bottom line—can the *Gal* fly?"

"Is that any kind of faith to be showing in our fine lady? Or her equally fine chief engineer? You just get us a cargo, and we'll deliver it."

An airport cart was coughing across the tarmac toward the *'Bama Gal*. Pops squinted at it. "Chadda's back. Maybe he has a line on something." He dropped the sprayer, slung the rifle over a shoulder, and followed Sean down the ladder.

They walked in the cool shadow of the fuselage toward the nose. The *'Bama Gal* was a sleek eagle twelve feet longer than the vintage 747 at the El Al freight terminal. Its wings were out wide in the subsonic configuration. Access hatches had been popped all over the belly, exposing the twin airturboramjets, the supersonic combustion ramjets behind them, and the main rocket in the tail. Tools and parts had turned the tarmac into an obstacle course.

The cart slowed down enough for its passenger to jump out. Chadda's white suit, well-shined shoes, and panama hat looked stylish if a bit out of place. An old knife scar marred his tobacco-colored face. He had a small package under one arm.

He joined Pops and Sean below the *'Bama Gal*'s stiletto nose. "Greetings, my friends!" he shouted through the scream of a jet engine. "How goes the work?"

"Could be better, could be worse," Pops answered. "We can haul out of here as soon as you find us a paying customer."

Chadda rolled his eyes skyward. "Allah deliver me."

"You struck out?"

"I planted seeds in parched soil. The local merchants are penurious and timid. But I won't fail you."

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"What's that?" Sean asked, pointing to the package.

"A present for Wo."

Sean slid a com out of his pocket. "Wo," he growled into it, "hit the deck running. We're out front."

"Coming, sir."

Moments later the cockpit hatch popped, its ladder deployed, and Wo climbed down. The coveralls hanging loosely over his skinny body were bright orange and immaculate. His face was a wedge with almost no chin, topped by a bowl haircut. He hurried over to them and nodded his head. "Sirs."

"You got the radio panel patched yet?" Sean asked him.

"I was attending to it when you called. I apologize for the delay, but a useful modification occurred to me while I was working."

"No problem. Our Pakistani packrat has something for you."

Chadda handed the package to Wo. "My friend, you asked me to obtain replacements for the AI chips in the avionics. Allah provides. I trust these will do."

The package had a Texas, USA return address. Wo opened it and stared, his mouth dilated into a big black hole. "These are MCC's top-line parallel processors! They must have cost a great deal of money."

"Their acquisition didn't deplete our resources by a single rupee."

Pops turned to Chadda. "Nice work. What kind of a scam did you pull to get them?"

"Scam? You wound me. I merely informed MCC that the distinguished theoretician Doctor Murtala Shagari, currently on sabbatical in Kigali, was preparing an article about their AI chips for a prestigious journal. They generously sent these comps."

Wo shook his head. But his frown evolved into a fatuous smile as he admired the chips. "Uh . . . I believe I will return to my work . . . if you will excuse me—"

"Go on, git," Pops laughed.

Wo trotted back to the ladder.

Chadda sighed. "Ah, the innocence of youth."

"Two things we sure don't have to worry about anymore," Sean said dryly.

Pops was still keeping an eye on the neighborhood, so he spotted the bike first. A kid was pedaling in their direction just fast enough to stay upright. "Company coming," Pops drawled.

The kid, built out of toothpicks, jumped from the bike and yanked a crumpled envelope out of a back pocket in his jeans. "Message for Captain Becker!" he shouted, waving the envelope. "Message for Captain Becker!"

Pops found some coins and tossed them to the kid. The kid snagged them all in midair. Grinning, he slapped the envelope into Pops's big palm, retrieved the bike, and wobbled away.

The others watched as Pops opened the envelope and read the single sheet of stationery. "Chadda, looks like one of your seeds is sprouting," he said. "A Mister Cecil Drake wants to meet me at four in the International's bar to talk business."

Chadda shook his head. "The name is not familiar to me."

Pops glanced at his watch. "It's three fifteen. Sean, you and Wo keep after the maintenance. You're on guard duty now." He handed the rifle to Sean.

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"Don't let anyone steal the *Gal* out from under you."

"Count on it. I'll even finish the spray job for you." Sean headed back to the port wing.

Pops turned to Chadda. "Izzie is somewhere on Bar Row trying to catch VD. Think you can track him down by four?"

"Allah will guide me."

"Good. See you both at the International."

Chadda strolled toward the passenger terminal, looking like he owned everything in sight.

The back of the hangar had been partitioned into a bunkhouse. Pops took a quick sponge bath, combed his fringe of silver hair, and put on his lone tropical suit. Then he hiked over to the passenger terminal to catch a taxi.

At three fifty he walked past listless palm trees into the airy lobby of the International Hotel. The bar was a dim hole beyond the chairs and potted plants, almost empty. He staked out a back booth big enough and private enough.

A tall stacked waitress stuffed into a short tight outfit drifted over. "May I bring you something?" she asked indifferently.

"A double Cutty on ice, please. And if someone comes in looking for Captain Becker, aim him this way."

She left, and he smiled at the rear view.

He was halfway through the Scotch when Chadda and Izzie showed up and slid into the booth. Izzie was handsome in the way the British used to call dashing: a narrow waist, broad shoulders, wavy blonde hair and a ruddy face. His Israeli Air Force uniform was sharply pressed and spotless except for some makeup on the collar.

"I found him at the Xanadu with his latest whore," Chadda said.

"Marie isn't a whore!" Izzie objected. "She's a sweet, lovely young lady who works in the airport gift shop."

"If your ladies are all so sweet, why are you always broke?" Pops asked dryly.

Izzie laughed. "Because I like to see the joy in their faces when I buy them pretty things."

"Did Chadda fill you in?"

"Indeed. Very mysterious. I don't suppose you have a notion what this Mister Drake wants?"

Pops shrugged. "You'll find out when I do."

"That revelation may be upon us," Chadda whispered without moving his lips. Pops followed Chadda's covert glance, and saw the waitress pointing out the booth to a new arrival. The man was in his middle years, pale and well-fed. He wore a quietly expensive dark suit that was bearable thanks to the hotel's air-conditioning.

The man walked over. "Captain George Becker?" His accent was upper-class British.

"Pops will do. Mister Drake?"

The man nodded. "Have a seat," Pops said. He waved the waitress over as Mister Drake settled in, and everyone except Chadda ordered.

Mister Drake handed Pops a fancy silver-embossed business card. Pops glanced at it, then passed it around. "Eldredge and Peel, Solicitors," Pops said. "You're a long way from London, Mister Drake."

"Our firm specializes in international

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and space law. I'm here on behalf of a client."

"Your client has a name?"

"All in good time. First I need to know a little more about your, ah, company than I've been able to unearth. If you don't mind?"

Pops shrugged. "Ask away."

"According to my sources you're an independent space freight company, rather more independent than most. A gypsy operation. It sounds very colorful and unlikely."

"So you're wondering if we're really in somebody's pocket," Pops drawled. "Well, we aren't."

He paused. "I used to be a pilot for Orbital Freight, flying Boeing 910's like the *Gal*. About eight years ago we both became obsolete. I hit mandatory retirement, and the company replaced me with someone younger and cheaper. Meanwhile the 910's were being phased out for the new higher/heftier 920's.

"I wasn't ready to go drool on some park bench. The independents were starting up then, taking the scraps from the space boom the companies didn't want. I found four other unwilling Orbital Freight retirees. We pooled our assets, got a bank to go us a loan, and saved the *Gal* from some Third World air force. We also pissed off our kin who had their inheritances all but spent. Anyway, that left us free to go where the cargos are and keep flying."

Mister Drake looked at Chadda and Izzie. "Your associates seem somewhat on the young side to be retirees."

"There were five of us in the beginning," Pops said half to himself. "Colby Olds died from a fever in Singapore, Dennis Arnon was killed when Bolivian rebels tried to hijack the *Gal*, and Jeff Muscatine's heart just quit pumping one day. Sean Killeen and I are still hanging on. We found replacements for the others."

"Five men are sufficient to operate and maintain your spaceplane?"

"We manage. Sean was the best ground crew chief Orbital Freight ever had—they were damned fools to run him out. He knows everything worth knowing about the *Gal*. His assistant is Wo Fong, an electrical engineering genius even if he is a young squirt. We lured him away from his Canton R-and-D job with the promise of high adventure and low pay.

"I'm the pilot, and Izzie Cohen here is our co-pilot. Izzie flew fighters for the Israeli Air Force until his womanizing got him in trouble. And this is Chadda. He's our scrounger."

"Scrounger?" Mister Drake asked.

"Procurer, business rep, liaison, and general problem solver. We ran across Chadda in Lahore, and offered him an alternative to going to prison for fraud."

"A low point in an otherwise illustrious career," Chadda murmured.

Silence wrapped around the booth as the drinkers lifted their glasses. At last Mister Drake nodded slightly. "I'm impressed, Captain Becker. I believe we can do business."

"Good. I'd hate to think I babbled like an Alzheimer's case for nothing. What and where?"

Mister Drake pulled a fat envelope from his inside coat pocket, and laid it on the table in front of him. "Our firm represents the orbiting factory complex Europa One."

"Shit!" The word blew out of Pops

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as though he had been gut-punched. Chadda's expression stayed unreadable.

Izzie's laugh was a loud braying that drew looks from around the bar. "Now I know we've hit rock-bottom," he gasped. "Pops, you and Chadda make a break for the door. I'll cover you."

"Shut up. Let's hear the man out."

"Thank you," Mister Drake said. "Europa One is in desperate need of supplies. I'm empowered to hire you to deliver a shipment there and bring back a shipment of the pharmaceuticals it produces. I have the contract with me, as well as a bank draft for twice the going rate. The supply shipment can be here in five days."

"Wouldn't your firm prefer to put its trust in Okitsu Hypersonic, Orbital Freight, or some other reputable company?" Chadda asked in a well-oiled voice.

"The major space freight companies are boycotting Europa One. A totally illegal action, but by the time we can establish that in court the issue will be moot. The real sponsors of the boycott are of course the space industry companies."

"They have billion-dollar-plus investments to protect," Izzie said. "If Europa One gets away with declaring itself independent, other space complexes might develop notions."

"The employees of Europa One aren't pirates trying to steal the complex from the Eurospace Corporation. You know how dangerous space operations are even under the best conditions. When corporate officials on Earth add to those dangers by trading safety for profits, it becomes intolerable. The employees plan to buy Europa One and operate it themselves."

"But Eurospace doesn't want to sell its golden goose," Izzie pointed out.

"The employee buy-out we've drafted rewards the Eurospace Corporation quite handsomely for its investment. The legal mosaic of suits, counter-suits and negotiations is dizzying, but in the end we'll win. Unless the boycott forces Europa One to give it up first. Which is where you gentlemen come into the picture."

"Starving people into submission must violate some law or other. Why not go to the UNSA for help?"

"You're making a joke? The United Nations Space Agency is a traffic controller and nothing more. The Americans and the Soviets won't let each other or anyone else police space. 'No law above the stratosphere' remains an apt phrase."

"There are many independents," Chadda said. "Why seek us out?"

"He's probably worked his way to the bottom of the list," Izzie cut in. "Anyone with enough brains to fly a spaceplane is too smart to go against the companies."

"True, you aren't the first ones I've spoken to. But you have, ah, certain qualifications that make you well suited to the task."

"Like being broke and hard up?"

"Your years of operating in the least civilized parts of the world have honed your survival skills. The boycott sponsors may take some, ah, direct action to prevent delivery of the shipment. I happen to know you're well equipped to defend yourselves."

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"You better spell that out," Pops said.

"Don't misunderstand me, I'm not criticizing. A spaceplane is a very tempting prize. I must confess some curiosity how you managed to acquire a military laser—"

Pops looked around quickly, then spoke in a low voice. "Private possession of a military laser is good for twenty years of federal room and board. We have a standard navcom laser, and that's it."

The corners of Mister Drake's mouth rose ever so slightly. "Of course. My apologies, I was misinformed." He slid the envelope across the table to Pops.

Pops opened it, read the key clauses of the contract, and glanced at the draft. "We'll make the run."

Izzie stared at him. "The companies won't appreciate our interfering. It could be a one-way flight."

"They all could. You want to sit this one out?"

Izzie's face turned even ruddier. "I wouldn't miss it, Captain."

Pops looked at Mister Drake and tapped the draft idly. "This is a nice down payment. Bring another one like it when you deliver the cargo."

"Four times the going rate? Don't be absurd."

"Cheap for what we'd be taking on. If you don't like it, find someone else."

Pops and Mister Drake locked eyes for several seconds. Finally Mister Drake nodded. "Done."

The process of going over the contract took Pops, Chadda, and Mister Drake almost an hour. Izzie passed the time by checking out the bar's meager action.

When they were finished Mister Drake rose from the booth. "I'll see you gentlemen in five days. Good evening." He left the bar.

"Good luck would have been more to the point," Izzie muttered after him.

They took a taxi back to the airport. Portable floods lit the *'Bama Gal* and the surrounding tarmac. Sean was sitting on top of the fuselage with the rifle in his lap, but he hurried down and Wo emerged from the cockpit hatch to join them under the nose.

Pops filled the two engineers in. Wo was enthusiastic about helping the underdog Europa One. But Sean shook his head and said, "Alas, my poor lady, what have we gotten you into this time?"

"Double watches every night until takeoff," Pops announced. "Everyone looks over his shoulder all the time."

"What manner of trouble are you expecting?" Wo asked.

"You name it. Sean, Wo and Izzie can help you set up the fuelmaker. Chadda and I are going to wave this check in the night manager's face and get the umbilicals turned on."

"A modest gift to that greasy pig will smooth our way," Chadda advised.

Soon the elderly one-lung fuelmaker, looking like a moonshiner's nightmare, was snuggled against the *'Bama Gal*'s side. A thick cable and a flexplas hose connected the fuelmaker to the airport's metered electricity and water. The compressor rumbled, white vapor climbed into the darkness, and a thick frost formed where liquid hydrogen was flowing into the *'Bama Gal*'s fuel tank.

"If we flew out of decent airports, we could buy fuel instead of having to brew it ourselves," Sean complained.

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"If we flew out of decent airports," Pops replied, "we'd be starving while the companies took all the cargos."

The next four days were busy ones for the crew of the *'Bama Gal*. Sean invested some of the bank draft in the most urgently needed replacement parts, and he and Wo hustled to un-defer as much maintenance as possible. Early the fourth morning he switched the fuelmaker to filling the LOX tank. Pops and Izzie figured a flight plan using the tower's UNSA datalink and the *'Bama Gal*'s avionics. After filing it they became semi-skilled help for Sean and Wo. Chadda split his time between procuring and nosing around Kigali for trouble aimed their way.

"I mistrust this serenity," he told Pops. "But if anything is afoot, it hasn't reached the bazaar."

Takeoff was scheduled for 10:40 P.M. on the fifth day. That afternoon Mister Drake arrived with a bank draft and a pair of flatbed trucks carrying cargo containers. Sean was in his usual foul mood during the loading and pre-flight inspection, but when they were done he told Pops, "She'll fly." At 9:40 P.M. he finished topping off the tanks, and they rolled the fuelmaker back into the hangar.

The night was warm and cloudless. The *'Bama Gal* crouched in the puddle of floodlight illumination, white vapor rising from its tank vents, ready to go. Pops, Izzie, Sean, and Wo emerged from the hangar in their bulky silver flight suits, carrying helmets and space kits. They walked over to the cockpit hatch ladder. Chadda waved a rifle from his guard post. "Allah watch over you, my friends!" he shouted.

"Try not to get arrested for anything while we're gone!" Pops shouted back.

The cockpit of the *'Bama Gal* was aluminum and gray plastic, a too-small space filled with soft yellow light. The controls were a mix of original equipment and Wo's juryrigs. Pops and Izzie strapped into the two forward pilot seats, Sean squeezed into the flight engineer's seat, and Wo took the com station. Helmets and kits were stowed under the seats.

Pops bowed his head and recited the airman's prayer. Sean crossed himself, Izzie whispered something in Hebrew, and Wo looked thoughtful.

"Everyone ready?" Pops asked. When he received three affirmatives he said, "Good. Let's get to it."

Hands moved over the control panels. Eyes scanned the data glowing in the colorful displays. Low voices gave status reports. Ears listened carefully to the equipment sounds. System by system the complex organism that was the *'Bama Gal* woke from its sleep.

Pops peered out the windshield at the airport's night face, floodlit buildings and a cross-hatching of runway lights. The whine of the gas generators compressing air for the ATR's was swallowed by the harsh roar of hydrogen jet combustion. Pops goosed the throttles, and the *'Bama Gal* taxied to the transient ramp.

He switched on his mike. "Kigali ground, Clipper Seven Victor Tango. IFR to Europa One."

"Clipper Seven Victor Tango, Kigali ground," a sleepy female voice yawned in his headset. "You are cleared to Europa One."

She gave the departure control and

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transponder frequencies, and Wo typed them in at the radio panel. Some airport workers were standing near the ramp to watch the takeoff.

Pops requested permission to taxi to a runway, and was told to go to three two right. The *'Bama Gal* rolled onto the end of the runway. It stretched away into a tunnel of darkness.

"Kigali tower," Pops called, "Clipper Seven Victor Tango ready to go on the right. Waiting for IFR release."

He wiped a hand across his damp forehead, and glanced over his shoulder. Wo was concentrating on the com panels. Sean nodded. Izzie gave a jaunty salute.

"Clipper Seven Victor Tango, cleared for takeoff."

Pops acknowledged. His hands were knobby and wrinkled, but they worked surely. His drawl became a whip snapping out instructions to the others.

The ATR's revved, and the *'Bama Gal* lumbered down the runway. The shaking was bad enough to bang teeth together. Izzie chanted speed and remaining runway numbers.

"Get up!" Pops said under his breath. "Get up, you fat cow!"

At last, with the end lights way too close, the *'Bama Gal* lurched into the sky.

Pops was shoved back in his seat as the *'Bama Gal* climbed like a scared duck. He kept checking the radar for traffic. Banking to his course, he eased back a touch on the throttles. The noise and vibration softened.

"Clipper Seven Victor Tango, Kigali tower. Radar contact. Climb to flight level one one zero zero for orbital insertion. Good night."

"Kigali tower, Clipper Seven Victor Tango," Pops replied. "Thanks."

The lights of Kigali slipped behind, quickly disappearing in the darkness. Night surrounded the *'Bama Gal* except for the myriad beckoning stars. Pops rubbed the back of his neck. "So far so good."

"Was there ever any doubt?" Sean asked indignantly.

Wo had to raise his voice to make himself heard. "Sir, I have AOS from NAVSAT."

"Good," Pops drawled. "I'm tired of playing chauffeur anyway." He tapped some buttons on the avionics panel, checked the displays, then sagged loosely in his seat. "We're on auto."

A couple of minutes later Izzie reported, "Coming up on Mach One."

Pops stared out the side windows. He felt the grinding and shuddering as the wings swung slowly back into the hypersonic configuration. When they didn't fall off, he took a deep breath.

"You worry too much," Izzie laughed.

"That's how he still happens to be alive, sonny," Sean said.

The *'Bama Gal* kept climbing and building up speed. It was laying out a long contrail of white water vapor hidden by the night.

"Mach Two," Izzie reported. "ATR's to ramjet mode."

Izzie's airspeed readings came faster. At Mach Five Pops turned to Sean. "The scramjets okay?"

"We'll sure as hell know in a minute."

When Izzie chanted, "Mach Six," the *'Bama Gal* bounced like it had been kicked in the rear. The roaring became

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higher in pitch as thin air was compressed a hundredfold by the *'Bama Gal*'s shock wave and the scramjets' contours, injected with liquid hydrogen, and ignited. "Scramjets lit," Izzie added in a tight voice. "ATR's down."

"Pretty sloppy conversion," Pops said dryly to Sean.

Sean was busy scanning displays. His frown slowly turned into a thin smile. "All systems are nominal. For that you can thank your gifted chief engineer."

The *'Bama Gal* finished a long curve which brought it to the equator heading due east. Pops looked down at the world, and saw the fuzzy terminator crawling toward him. It was dawn over India.

"One hundred ten thousand feet and holding," Izzie reported.

The *'Bama Gal* stopped climbing at the scramjets' operational ceiling, but it didn't stop accelerating. Pops watched the scenery unroll downstairs. India and Sri Lanka were tan with patches of pale green, and the Bay of Bengal was cloud-flecked blue. "Nice view today," he said.

"Better to come," Sean reminded him.

Izzie's airspeed readings reached Mach Fifteen. "Piledriver coming up," Pops said. "Get ready." He tightened his straps, then let his head and arms settle into the rests. The others did the same.

"Mach—"

The five-*g* burn of the main rocket squashed the second word in Izzie's throat. The avionics shut down the scramjets. But the rocket sounded like their bigger, louder brother. No one spoke, moved, or even breathed much under the terrible pressure. Faces were flattened into skeletal masks. Sean whimpered like a hurt kitten.

Ninety-four seconds dragged by. Then the rocket died, and the acceleration was abruptly replaced by freefall.

"Status reports," Pops gasped as he rubbed aching muscles. The reports came in slowly.

Sean looked like he was about to puke. "You okay?" Pops asked.

"About average for going the distance with Godzilla and really missing gravity."

"Take some avomine, tough guy."

"And nod off on duty? Forget it."

The *'Bama Gal* was coasting up to Europa One's orbit at 21,600 MPH, almost Mach Thirty-Two. Tiny island-dots and storm fronts were spread across the Pacific. The horizon curved, and blue sky had given way to black space. The cockpit was quiet except for equipment sounds.

Izzie unstrapped and started tumbling in midair. "Nothing to do now but relax until we reach Europa One."

"Wrong," Pops said. "Get back in your seat and glue your eyes to the radar. Sean, check all the emergency systems. Wo, rig the combat gear."

Wo frowned. "Are we in imminent danger of attack, sir?"

"Humor me."

The others went to work while Pops kept monitoring the flight. The *'Bama Gal* didn't carry its military hardware out in the open for customs inspectors to find. Wo unbolted a deck plate, revealing part of a fat metal pipe. The free electron laser's accelerator ran from the underside of the nose back to the tanks. He made the power, refrigeration, and control connections to the inboard systems. Then he fetched the traveling wave tube from its hiding place, and plugged it into what was officially the backup radio transmitter. After some

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tests at the com station he told Pops, "The defensive units are deployed, sir. I pray we won't have to use them."

"That makes two of us."

Then Wo played stewardess, heating coffee and burger pacs at the galley alcove. Everyone ate except Sean who, still pale and queasy-looking, stuck to the coffee. Izzie kept watching the radar, and the others watched him. Conversations died young.

Europa One was in an orbit 5,750 miles above the equator. Wo picked up its transponder on schedule. When the final approach began Pops reached for his headset and mike. "Time to raise Europa One for docking instructions. Looks like a milk run after all."

"I'm afraid not." Izzie's voice rasped with excitement. "Check out the scope."

A blip was dropping toward the *'Bama Gal* from a higher orbit.

"Shit!" Pops erupted. "Suits tight." He put on his bowl helmet, plugged the umbilical into the seat, and pressurized. He made sure the others were tight, then asked Wo over his suit com, "Getting a transponder?"

"No, sir. I am running the configuration identification program." The USAF software was something else they weren't supposed to have. A few seconds later Wo said, "It is a Boeing 920C spaceplane."

"At least it's not a military plane," Sean growled.

"But it can still fly rings around us." Pops was staring at the radar. "And we're too low on fuel for much of a dogfight."

"Shall I raise Europa One, sir?" Wo asked.

"Don't bother. They can't help, and we don't have time to chat. We ought to be getting a call from—"

"A message is coming in from the unidentified spaceplane," Wo interrupted diffidently.

"I'll take it." Pops switched to the radio channel. "Unidentified plane, Clipper Seven Victor Tango. State your business and get out of our way."

"Cut the crap." The radio voice was gravelly American. "Your mission is scrubbed. Retro burn and head home."

"Identify yourself," Pops demanded.

"Go to hell. Europa One is off-limits."

"You got something to back up that big mouth?"

"Just these."

Two dots broke away from the blip and moved toward the middle of the radar screen. "Missiles incoming!" Izzie yelled. Pops was about to slap attitude rocket switches when he saw they were going wide to starboard.

Wo was staring at his computer screen. "The missiles are Soviet OO–3 ASAT's. They are equipped with radar homing systems and conventional warheads." His voice broke, and ended in a gulp.

"Convinced?" the radio voice asked. "I don't want to have to turn you into a meteor, but it's my job to see no supplies reach Europa One."

"We need a minute to think it over," Pops said, and switched back to the crew channel. "Izzie, take the con."

"What?"

Pops took a deep breath, and his words came slowly. "I can't outfly a 920. You're thirty years younger than me, and a fighter jock. Can you?"

"I can give it one hell of a try, Captain." Izzie saluted, then told Sean, "Shut down the overrides."

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"You're crazy! You try fancy maneuvering without the avionics, you'll wreck the *Gal!*"

"I need those safety margins. Do it."

Sean looked at Pops, but Pops didn't say anything. Sean sighed and typed the instruction.

"May I remind you, sir," Wo said to Izzie, "that our converted industrial laser is extremely limited in effective range, and that it requires fifty-four seconds after each use to power-up."

The attacker was getting close, diving like a hungry hawk. "Hang on," Izzie said happily. "It's going to be a bumpy ride. Wo, begin electronic countermeasures. Give those ASAT's a headache."

"Yes, sir." Wo activated the "backup radio" and set out to confuse the homing radars.

Izzie's hands moved deftly even in the thick suit gloves. The main rocket fired, and the cockpit shook. The *'Bama Gal* stood on its tail, twisted savagely, and hurtled toward the approaching attacker at a half-*g*.

"We used to call this Bekaa Valley tag," Izzie said conversationally on the radio channel. "You know the game as chicken, I believe."

"You just bought yourselves body bags," the radio voice replied.

"Missiles incoming," Pops reported. He glanced out the windshield, and actually *saw* the twin white dots closing. He flinched as they missed by a handful of yards.

He checked the radar displays. "Fifteen seconds to collision," he said.

"Shoot, you idiot!" Sean muttered.

"Not yet." Izzie's smile had turned grim. "The first one to present a fat target loses."

"Ten seconds." Another pair of ASAT's stabbed past, even nearer than the first two.

"Five seconds."

The attacker jumped out of the stars dead ahead, a tiny model spaceplane growing way too fast.

"Three. Two—"

The attacker climbed in a frantic firing of attitude rockets. The *'Bama Gal* climbed too, so its nose aimed at the attacker's gleaming belly. Izzie looked at the screen serving as a sight. He thumbed the trigger button.

The laser pulse was invisible, but its effect wasn't. A fine line appeared over the attacker's liquid hydrogen tank. Pale vapor spewed out.

A split-second later the *'Bama Gal* shot by the attacker's port wing. Pops cringed.

Izzie swung the *'Bama Gal* around, and Sean used binoculars to scan the attacker. "It's drifting," he reported. "Lost all its fuel, or too damaged to risk a burn."

Everyone started breathing again. Pops and Sean looked relieved, while Wo smiled tentatively. Izzie gave a cheerful thumbs up.

"Good flying," Pops told Izzie. "You got around its speed advantage nicely. But what would you have done if it hadn't veered?"

"In that case, Captain, the question wouldn't arise."

"I am receiving a Mayday from the unidentified spaceplane, sir," Wo said.

Izzie shrugged. "Let Europa One handle it, if they have a mind to."

Everyone depressurized suits and took off helmets. Wo listened to his headset, then said, "Europa One is acknowledging the Mayday and dispatching a tow

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sled, sir. . . . Director Channing wishes to speak to our captain."

Izzie glanced at Pops, but Pops shook his head. He looked like someone had let the air out of him. "You won your spurs, Izzie. You're Captain Cohen now, and I'm your co-pilot."

The others stared at him. "Don't be ridiculous," Sean snapped.

"I'm being sensible." Pops took a deep breath. "Izzie flew the *Gal* better than I can. A man ought to know when it's time to step aside."

"Okay," Izzie said. "My first official act is to promote you back to captain and demote myself."

"Quit kidding around. You better talk to Europa One and get us docked."

Izzie leaned back, putting his hands behind his head. "That's not my job, Captain. If you won't take back your command, I suppose we'll just float out here."

Sean was frowning. "Meaning no disrespect to Izzie, who's a damned fine pilot, but you're the *Gal*'s captain. Period."

"It is as he says," Wo added.

Pops turned away. When he turned back, the air had been pumped in again. "Wo, I'll take Director Channing's call if he hasn't given up yet. We've got a cargo to deliver."

"Yes, sir."

"When you're done with that, Wo, get over here and take my station," Sean groaned. "I'm—"

He passed out.

Europa One was a spinning silver coin. The *'Bama Gal* and the attacker sat like flies on the middle of each side, snuggled in the docking cradles. Space-suited figures were busy working on both spaceplanes.

Pops could see some of the activity through the Bifrost Lounge's big window. He drank his Scotch carefully in the two-thirds *g*. The center of Europa One's social life was jammed with happy people, but he and Gretchen had managed to find a free table.

He smiled at the milk-skinned blonde tall enough to look him in the eye and young enough to be his granddaughter. "I do appreciate the interest," he assured her. "But why would a lovely young lady like you want to waste her time with me?"

Her English was as thick and sweet as a Vienna dessert. "You are my hero, darling. You won through and saved us. I have you, and there are at least fifty women in this room hating me for it."

He slid an arm around her shoulders. "So that's your game. Better be careful—I may not be as safe as you think."

She took his other hand in hers. "I don't think you're safe," she said softly.

Director Channing emerged from the crowd in front of them. He was a trim, well-dressed man with the face of a perpetual worrier. "My apologies for intruding, but I must speak to Captain Becker."

Gretchen pouted for a moment, then warmed Pops's mouth with a kiss, said, "Later, darling," and bounced away.

Director Channing filled the vacant chair. "I'm pleased to hear your man Sean is better. But Doctor Lucci tells me he left the infirmary against medical advice. He should have three more days of bed rest. Broken ribs and internal bleeding are serious matters."

"He's supervising the *Gal*'s port maintenance," Pops said. "He'll be okay. He's tough, even if he does look like a dirigible."

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"Very well. I trust the rest of you are enjoying your stay?"

"The natives are very friendly. Izzie has been partying, and Wo has been hanging around with some of your tech types."

"Mere hospitality is a small reward for the prize you've given us," Director Channing said.

"The 920? Hell, we dumped a hot potato in your lap because we couldn't handle it."

"You might be interested in the fate of the hot potato. It turned out to be part of the Orbital Freight Company's fleet. There was a covert arrangement between that company and Eurospace."

Pops grinned.

"Our possession of the spaceplane put Orbital Freight in an embarrassing position," Director Channing went on. "They were out a valuable piece of property. They couldn't claim we hijacked it without admitting what it was doing here in the first place. So they couldn't go to court to make us return it, or even get a recovery from their insurer. Their stockholders would have been very unhappy."

"Except?"

"Except we negotiated a settlement. The spaceplane is now chartered to us at a very reasonable rate. Orbital Freight gets to keep it on their books, and we get a regular shuttle service. We'll return their mercenaries to them—as soon as the gentlemen are released from the infirmary."

Pops rubbed the scraped knuckles on his right hand. "Accidents will happen."

"Indeed. Anyway, we would really prefer to have two spaceplanes for the shuttle service. Would you consider becoming part of Europa One? We can provide substantial financial benefits, enlightened management, and first-class support. Not to mention a permanent home."

Pops looked past Director Channing, out the window at the sapphire and white swirls of the gibbous Earth. "That's a mighty tempting offer, and we thank you for it. But there are too many places we haven't been yet for us to get tied down. We like working for ourselves. You should understand that better than most."

He lifted his glass in an unspoken toast, and emptied it. ■

(continued from page 103)

in the kinetic energy we develop. Then we can decelerate for the remainder of the distance withdrawing the energy and returning it to storage as we reach our destination.

Of course, the problem here may be that we don't happen to be located near any of the "string-roads" that perhaps span our galaxy. Maybe we live out in the boondocks, far from the nearest string rail-line. Perhaps *that's* why nobody ever comes to visit us. ■

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By Tom Easton

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. . . And the Lurid Glare of the Comet, Brian W. Aldiss, Serconia Press (P.O. Box 1786, Seattle, WA 98111), $13.50 (plus $1 shipping and handling for mail orders), 123 pp.

Envoys of Mankind: A Declaration of First Principles for the Governance of Space Societies, George S. Robinson and Harold M. White, Jr., Smithsonian Institution Press, $19.95, ? pp.

I wish more writers were like Mike Resnick. He sends me his manuscripts routinely, at the same time he delivers them to his publisher. And he thereby delights me, for he lets me, for a change, publish a review that will appear on or near the book's publication date, instead of months later. What's more, I can write the review months ahead of time and hold it for the right column, which gives me a little less work to do when that month rolls around. Out of gratitude, I generally send him a copy of the review when I write it. If it's a good review, he can then send it to the publisher for excerpting on the book and in ads, which is what he did in the *Santiago* case that prompted one reader to complain in "Brass Tacks" about unseemly coincidences. If it's a bad one, he can bury it in the backyard.

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Any writer who sends me a manuscript gets treated in the same way. The trouble—the appearance of special treatment for Mike Resnick—arises because most writers prefer to leave sending out review copies to their publishers, who don't make a move until too near the publication date for a review to be timely. I, like my predecessor in these pages, wish it were otherwise, but . . . Anyway, here's the latest, Mike Resnick's **Stalking the Unicorn.** He sent it to me a year ago, the publication date is February, and this is the April column, which will be available while the book is still on the stands. My review should thus be of more help than usual as a buying guide.

Despite my pleasure at getting manuscripts, I was disappointed. Perhaps I shouldn't have been. He's tapping the same vein he was with *Adventures,* sending up a pulp genre of the past. This time his target is detective fiction, and his hero is John Justin Mallory, a boozing shamus who yearns for a Velma and has to settle for an elf.

The elf, Mürgenstürm, shows up in Mallory's office one New Year's Eve with an assignment: The unicorn he was guarding has been stolen by Flypaper Gillespie, a leprechaun working for the Grundy, a demon. After a suitably rollicking repartee, Mallory takes the case, Mürgenstürm leads him by odd twists and turns to a coincident Manhattan (just out the corner of your eyes) peopled by Subway Gnomes, trolls, elephant-riding cabbies, elves, and so on, and the chase is on.

As we might expect, things are not what they seem. Mürgenstürm is no innocent, and the Grundy is an honorable fellow in his way, working for the sake of Cosmic Equilibrium. He wants Larkspur, the unicorn, because of the ruby in its forehead, which will give him access to our world. He will then exert himself to balance good with evil. Mallory's victory, of sorts, stops him, but not in such a way as to give us much hope.

Resnick displays a thoroughly antic imagination here. There are cat people, a taxidermist so good his products don't know they're dead, an old folks' home in a mortuary, and many other rewarding tidbits. But the hard-drinking private eye has never been one of my favorite characters, and I am always pissed when a plot resolution hinges on authorial sleight-of-hand. How *the hell did the* ruby get into that salt-cellar?

And Resnick's comments on the role of evil in the world are not nearly as convincing as his thoughts on other matters have been.

Rob Swigart's **Vector: A Thriller in Paradise** is a more successful SF detective story, partly because it strives for neither broad humor nor philosophy. Hero Charles Koenig is a bioengineer who has let himself be recruited by a botanical research station in Hawaii. On his arrival, he encounters a series of fluke accidents and mysterious deaths. There is the KGB agent killed when a car wheel bounces off the back of a truck, the diver found floating in the water with an agonized rictus on his face, the young couple with their brains removed, the bum, the old woman. Soon recruited by the local police, he finds signs of neurotoxin in the victims' brains, the remnant of a virus, and other clues. He begins to suspect his employers, but when his estranged wife arrives and is kidnapped he finds a darker truth and an ethnospecific doomsday weapon.

Swigart is concerned with the darker implications of genetic engineering. The regulations are all well and good, he says, as long as people respect them

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and the spirit of caution behind them. But what happens when someone decides to ignore them in search of death? There is nothing to stop them, for the research is cheap and, unlike nuclear research, it leaves no tracks an outsider can detect, until the researchers begin to test their product in the world. Only then can anyone hope to spot it and stop it, and by then it is almost too late, as Koenig finds in his final race against time.

I enjoyed the book in every respect but one: Swigart has done a fine job of hard SF, but he has nearly marred it by insinuating a strong thread of mysticism with the Hawaiian kahuna (witch doctor). The kahuna adds a nice touch of local color, but he—or rather the success of his techniques—jars in the context of science. Fortunately, to my mind, Swigart views the kahuna's success skeptically, usually leaving room for nonmystical interpretation.

Ann Maxwell's **Timeshadow Rider** is much more heavily mystical, in the sense that her main characters have powerful psychic abilities and exist in a frame of prophecy, destiny, and fate. All the psi meant I had a hard time getting into the book, but once I did manage to suspend my disbelief, I found a potent tale that should charm the socks off adolescent females and sentimentalists of all ages and genders.

Maxwell has drawn a vision of a galaxy populated by beings of the "Fourth Evolution." They may or may not be our descendents of eons hence, for though she describes the results of the First Evolution as being living jewels and those on the Fifth as being able to move freely through all of space and time, she says nothing about the Second and Third. The people of the Fourth live in space pretty much as we know it, and a few—notably the Kiri of Za'arain—are able to sense and manipulate the flows and patterns of time. Most particularly, the Kiri sense the wakes people leave in time, their "timeshadows."

The ancestral Kiri used their strange sense in savage hunting until there appeared the Eyes of Za'ar. Worn by a suitably talented Kiri, the Eyes quelled the savagery in the Kiri soul and made civilization possible. In due time, the Kiri went out among the many species and civilizations of the interstellar Joining, where their talents lead to new heights of creativity and glory.

Now, however, a plague has swept the Joining and reached Za'arain. The wearer of the Eyes of Za'ar is dying, she senses a thief coming to steal the Eyes, and she lays it on her apparent successor, Sharia, to retrieve the Eyes and prevent the reawakening of Kiri atavism. Sharia will find help from her banished true love, Kane, but *she must not touch him* or worse catastrophe than a reign of interstellar Kiri terror will ensue: The universe itself will end.

Naturally, Sharia and Kane *must* touch. Driven by a destiny shaped by a myriad previous lives, they *must* fulfill their love. They resist mightily as they pursue the Eyes' thief and the salvation of the Joining, for they know the price. In the process, they learn much that may help them forestall disaster, and in the end . . .

Maxwell's tale is a romance of unprecedented grandeur. There are strange people, strange histories, strange customs. There are exotic scenes and bold adventure. But the theme is love—love thwarted, love blocked, love banned for the best of reasons, and love finally triumphant.

Robert Charles Wilson's **A Hidden Place** is a much, much quieter romance.

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As the Great Depression gathers steam, Travis Fisher, orphaned when his prostitute mother died of cancer, comes to live with his aunt and uncle in the small town of Haute Montagne and work in his uncle's dying ice plant. There he finds that his mother's life makes him an outcast and meets and loves Nancy Wilcox, whose father abandoned his family and left her, too, feeling out of place. The story becomes SF when he meets Anna Blaise, the mysterious boarder whom his uncle visits nightly, while his wife sleeps.

Eventually, Travis learns Anna's tale: She appeared by the side of the road one night, naked, and his relatives took her in. From her, he learns that her home is the realm we know as Faery. She chose to visit Earth on a voyage of discovery, in the process splitting into two personae, her quintessentially female self and a male archetype called simply Bone. They became separated, and she is lost, trapped on Earth until and unless they are reunited. But, Wilson tells us, Bone is living among the hobos, and his life is in danger. The reunion may never take place.

Anna despairs. A transformation, caterpillar-like, is upon her. She needs a place to be safe and alone while she awaits Bone's arrival and the change's consummation. Travis and Nancy vow to help, but Travis falters when he glimpses the truth of Anna's being. He flees to the local hobo camp while Nancy bears the burden of knowledge and protection.

Meanwhile, Haute Montagne resolves to destroy the hobo camp with a vigilante attack. Travis' loutish rival for Nancy's affections learns where they are sheltering weird Anna and aims for their destruction. Bone falls deeper into trouble. Disaster is imminent for all concerned.

The tale is of misfits fulfilling themselves, and hence perhaps ideal for those adolescents who fail to belong among crass, loutish peers whose imaginations know not how to soar, as well as for older folks who were once just such misfits. The tale is also of loves, playing teen affairs against ideal and archetypic love; against self-love, directed toward a mirror; against love for independent others. And again it offers salutory vicarious lessons for its readers, old and young.

Are the lessons too blatant? I don't think so. They're there, but I do go looking for the things, in the same spirit that my daughter applies to the "Find the banana" drawings in her magazines.

Victor Kelleher's **The Beast of Heaven** appeared in Australia in 1984 and won the Ditmar Award for the best Aussie SF book. Now it's available here, and it deserves a few words, for it is a masterful display of irony.

The irony is underlined by the book's only neologism. The "mustool" is the sole food of the Gatherers, a band of sentient creatures who behave much like humans, although . . . To them, the mustool is a delicious mushroom and their staff of life. To us, it would be a poisonous toadstool.

As the tale begins, the Gatherers are debating whether to leave the highlands, whose soil is losing its "sweetness," for the unknown valley. The tribe's shamans are the Reader Pella, who uses a magnifying glass to read the wisdom of the old days from scraps of antique microfilm drawn from a sack, presumably at divinely inspired random, and the Sensor Hyld, who "hears" the ghosts of the past attached to artifacts, skeletons, and the ground itself.

Unbeknownst to the Gatherers, the valley holds a self-repairing computer installation whose builders had split the computer into two personalities, in-

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structing them to debate each other until they had decided whether to give humanity control of the ultimate Bomb. Unfortunately, though that seems like a nifty way to duck responsibility for Armageddon, people didn't wait. They had their war anyway, with not-so-super bombs, and turned the planet into a wasteland in which only the mustool can grow.

The Gatherers descend to the valley, where a Beast of Heaven, ordinarily a mindless, horned dust-eater whose females provide the Gatherers with a healing milk (I thought at first it must be a mutant descendant of cattle), discovers how good they taste and becomes a ravening monster. Eventually, they discover the computer installation and awaken it. It calculates its time to be 100,000 years in our future, and as Pella and Hyld explore its mysteries, it resumes its task. The final irony is twofold: the true identity of the Beast of Heaven and the effect of the super-bomb on the Gatherer's lives.

The tale is a fable for our times, a warning, a chastisement, well equipped with portentous symbolism. In this sense, it echoes a common mode of British SF, and in fact Kelleher was born in London (though he grew up in Africa). But he came to Australia in 1976, and his book is at least in part an expression of an active culture whose frontier memories are even greener than the U.S.'s, and of one that resents its vulnerability to the madness of another hemisphere. It is thus an active tale, as readable as many a mass-market U.S. product, and I commend it to your attention.

In his latest, **Arc of the Dream,** A.A. Attanasio falters. The story isn't bad, but the execution has severe problems, not least in the mumbo-jumbo that passes for neurophysiological explanations of muscle action and schizophrenia. Much worse may be the excessive floridity of the prose and the endless maunderings that attempt to express fifth dimensional reality. Together, they seem no more than padding on the frame of what might have been a strong novelette.

The story: A fifth-dimensional alien plummets to Earth to visit the cetaceans, leaving its metal brain and hyperdimensional energy field on a Hawaiian lava field. Alas, a gimpy orphan from a home on another island spots and pockets the brain, the arc, and walks off with it. Disaster! The arc must be returned precisely to where it sat, or in three days the energy field will blow up, totally destroying the alien, the island, and all upon it. Alas, the alien cannot communicate readily with Donnie. Its mind is too large for any one mere human vessel.

Shortly after the Home's resident bully, Dirk, confiscates the arc from Donny, the alien splits itself, conferring on Dirk the ability to know at need; on Jiang, an elderly Chinese peasant, great strength and telekinesis; on Reena, inmate of a French insane asylum, telepathy; and on Howard, a middle-aged, unemployed Illinoisian, clairvoyance. Now they must somehow come together and combine their talents to restore the arc to its niche.

There are, of course, obstacles: Jiang has no money and must cross great distance alone; Reena is locked up and must also come far; Dirk is in trouble with the local mobsters; and Howard, using his newfound talent to win millions in crooked card games, also has the mob after him. To boot, the alien's mind is degenerating as time passes and its pain builds, and its darker self is manifesting as a monster that seeks the failure of the rescue effort and its own death.

Success is inevitable, given the way

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the author stacks the deck: the superheroes' superpowers tend to be fluky, but they are more than enough to fulfill a simple mission, and the monster definitely fails to live up to its billing. So too is Dirk's change from punk to responsible youth and eventual mathematician as he learns the values of love and caring. Put all this inevitability together with Attanasio's failure to check his science and trim his prose, and we have a book that will make you wish you had spent your money on something else instead.

Once upon a time, George R. R. Martin and his good buddies Ed Bryant, Leanne Harper, Stephen Leigh, Victor Milán, John Miller, Lewis Shiner, Melinda Snodgrass, Howard Waldrop, Walter Jon Williams, Roger Zelazny, Uncle Tom Cobbley, and all, were sitting around the ranch schmoozing. And it came to pass that someone said, "Gee, I loved the comics when I was a kid! All those superheroes, ya know? BANG? BANG! KAPOW! ZAP!"

And someone else—the annals are silent on just who that someone was—said, "Yeah, but life ain't that simple."

"What d'ya mean?"

"Well, look—Here you've got Superman, or Batman, or whoever, stompin' on tinpot right-wing dictators all over the place. Wha'd'ya think Joe McCarthy would have had to say?"

And someone else said, "And let's turn the thing around, too—if you can have superpowers, why not superweaknesses?"

"But how . . . ?"

And the Great Cartoonist in the Sky drew a dazzling lightbulb over a head or two, and TAA-DAAAAHH!! We have it: *Wild Cards: A Mosaic Novel*, edited by George and with contributions from all the rest of the crew. The premise is that in 1946 aliens have designed a virus that is supposed to enhance their own superpowers, but it isn't reliable. Sometimes it kills. Sometimes it turns its victims into monsters. So the aliens decide to test it on Earth and send a ship with a giant aerosol can. One alien, Dr. Tachyon, disagrees with the barbarous plan, pursues the ship, fights it, and forces it to crash. The aerosol can then comes into the possession of an archcriminal, who releases the "Wild Card" virus over Manhattan.

The effects are immediate. Some people acquire various superpowers. Others die. Still others become freaks, or jokers, with elephantine trunks instead of noses, insect legs for fingers, and so on (there is even a Snotman). But the resemblance to the comics soon ends, for *Wild Cards*' superheroes live in a much more real world. There is not just superheroism, but pain and frustration as well. McCarthy is here to act out the world's envy. There is prejudice, and as the stories move toward the present there is a joker-lib movement. There are other issues as well, and the effect is of a fun-house mirror held up to our world.

We have here the writers at play, but at serious play. They are indulging themselves, but not pointlessly. And they have gifted us with some very good yarns. You will enjoy your reading, and you will look forward to the next volume.

That's right. *Wild Cards* is to be a series. I hope it doesn't wear thin as quickly as have some others.

Brian Aldiss at his best is perhaps the wittiest of all modern SF writers. The wit (which is not quite or always the same thing as humor) shows in some of his fiction, but it emerges most clearly in his essays. Of the essays collected in **. . . And the Lurid Glare of the Comet,** the wittiest are his discussions

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of "Robert Sheckley's World: Australia," "Grounded in Stellar Art" (concerning his *Barefoot in the Head*), and the role of artworks as stimulus to writing and wonder (a speech he gave when he presented two prints to his old boarding school), and they are enough to make the book worth buying. He gives us only bonuses when he turns to the influence of books; the forgotten Wells novel, *In the Days of the Comet;* Kingsley Amis's SF; visiting China; and a warm obit for Theodore Sturgeon. The biggest bonus of all, occupying nearly half the book, is his autobiographical essay, extended from what he wrote for Gale Research's *Contemporary Authors—Autobiography Series*. Here we learn a great deal about Aldiss's painful youth. We learn too something about why and how he became a writer; here the detail is scanty, but when he says, "I always wished to be someone. I felt myself less than the dust. My wish was to help, to reach out generously, to give generously," we understand what he is saying, and we admire the man as much as his work.

Less than half of **Envoys of Mankind: A Declaration of First Principles for the Governance of Space Societies,** by George S. Robinson and Harold M. White, Jr., is worth reading. The rest is a turgid, fatuous exercise in credulity. The space-lawyer authors seem to draw their knowledge of science from the worst of the Gee whiz! Gosh wow! popularizations—maybe even the tabloids. They try much too hard in their effort to make their field of law seem scientific enough to fit the space age.

To prove my point, I give you: "Every conscious movement is made in a manner that takes gravity into account—which is one of the most important underpinnings of civil, criminal, and evidentiary law in every legal system of the world." I find it difficult to swallow the idea that gravity has anything whatsoever to do with tax law, copyright law, or the prosecution of thieves, muggers, and murderers. They're reaching.

Would you like a little more? Try this, for an example of how they give far too much credence to the fringiest borders of the human-potential movement, pushing psychology and neurology far beyond their legitimate bounds:

> . . . prevalent in space habitats may be the communication of old, and the emergence of new, symptoms related to a general malaise, a sick-all-over or half-well feeling, now referred to by many practicing physicians as "functional disorder." This is simply another way of saying that the person is suffering from all the cumulative effects of a modern, technological society.
>
> Into this category are lumped alcoholics and other drug abusers, people suffering from high stress environments, and the average office worker who spends less than an hour a day in the natural electromagnetic energy fields of sunlight, totally bathed instead in a synthetically created energy spectrum that is alien in many critical respects to the spectrum in which the species evolved and survived. These are the people who, through an extended period, manifest ambiguous emotional illnesses, which themselves are frequently defined vaguely as disturbances of thought, feeling, and behavior and are observable as migraine headaches, fluctuating blood pressure, attacks of angina, allergies, dizziness, and skin and bowel disorders.

This too is reaching, even though it is in the service of the worthy goal of

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showing how the space environment is different from the earthly environment, and how people who live in it will necessarily develop different habits and patterns of thought. Therefore the law will have to adjust, recognizing, for instance, that negligence, responsibility, and reasonableness will acquire different meanings.

The point is worth making, but it could have been made much more concisely and convincingly. *Envoy*'s whole first half should have been condensed into a chapter or two, dropping the attribution of a striving consciousness to the entire universe, ever since the Big Bang and even at the levels of atoms and molecules, and concentrating on the context of space exploration in a history that includes Jason and Columbus and culminates, for now, with the modern astronauts and cosmonauts. Such a sharper focus would have made much more telling the authors' point that new environments awaken new issues of justice—including freedom and independence—and lead more smoothly into the discussion of space treaties and the legal needs of space colonists.

It is this last discussion that gives *Envoys* what value it has, for space law is a real field, and one of considerable interest to all who dream of living in space. It is meat for countless SF tales that feature Declarations of Lunar Independence or LaGrangian Constitutions, and the models of such documents the authors provide at the end will entice many readers. The "Convention for Spacekind" is a reasonable effort to address the needs of colonists and groundhogs fairly. The "Spacekind Declaration of Independence," however, is a tediously unreadable effort to cram new concepts and terminologies into the Colonial original. ■

(continued from page 8)

windows built right into our skins—and if you think going blind several times a year wouldn't color your outlook and disposition, I'd like to see you try it sometime.*

I realize that some of the more uppity among you may say I'm not really a very good example to convince writers that there are viewpoints all around them more alien than some of the ones they're trying to pass off as extraterrestrial. After all, you may say, snakes don't really count because they aren't very intelligent.

It would be beneath my dignity to answer that as it really deserves. Instead I will only ask that you think for a moment about Stan and me. Which of us has to work for a living, pay income tax, and occasionally even go into New York City? And which of us lives a life of almost complete leisure because he has the other trained to provide for his every need?

Now . . . which sounds smarter to *you*? ■

*Incidentally, Stan's been trying to convince me that those built-in eye shields make me ideally qualified to cut up onions, if we could figure out a way for me to hold a knife. But why would anyone *want* to cut up onions?

And while I've got your attention down here, what do you suppose a snake calls a "footnote"?

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brass tacks

Dear Sir:

In your September '86 editorial you expressed concern that the *Challenger* explosion might be used an an excuse to halt manned space flight (at least by the U.S.A.). We need a project that will win strong political support for people in space.

The results of a survey published in the July '79 issue of *Analog* indicated that American taxpayers support the near term practical uses of space but are unimpressed by idealistic motives for space flight, with colonization being the most unpopular idea. Manned Mars expeditions simply will not be funded at this time, and O'Neil colonies will remain blueprints for some time to come. Lunar bases, unless they can find a utilitarian function, are also a poor bet.

We are left with space stations. Why should the taxpayers fund a space station? Having read articles about NASA's proposed space station, I find the justifications, if any, rather vague. To service satellites or manufacture pharmaceuticals, wouldn't an unmanned platform be adequate? Can the manufacture of a few exotic alloys pay back the research and development costs of a big space station?

In the March '84 issue of *Spaceflight*, David Ashford proposed that space tourism may be the key to the universe. What?!!! How absurd!!! How can manned space flight be justified for something so trivial as tourism? Because space tourism may be the first use of space to justify a low cost shuttle while capturing the imagination of the public.

Tourism is big business. It supports the construction of cruise ships and airliners. It supports hotels. People are enthusiastic about their vacations and will pay for them even though they serve no scientific, military, or practical pur-

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pose. Unmanned instruments are no substitute if you intend to *play* in space, and a Proxmire would antagonize the voters if he tried to kill their vacation plans.

Ashford pointed out that a workable space hotel might be built using existing hardware. Spacelab modules might be joined together, or perhaps *Columbia* or *Atlantis* will orbit their External Tanks for conversion into habitats.

NASA wants a big new project, and a second generation shuttle cheap enough for truck drivers and secretaries should be challenge enough.

TIM WALKER

Seattle, WA

Dear Dr. Schmidt,

Last September, you wrote an article for *Analog*, in which you worried about the anti-NASA response to the Challenger disaster. Don't you think that's rather healthy? While I too would oppose the complete gutting of the space program, this disaster has shown us, the hard way, that NASA and the public were taking too much for granted. While I am not opposed to civilians in space, we must keep in mind that spaceflight is still not safe or cheap enough for a joy ride.

This is why I opposed Mrs. McAuliffe's flight. Even she admitted, in her own way, that the flight would have been little more than a publicity stunt for her profession. I'm sure that you have never been in space, yet, in this magazine, you and your writers have taught me more astronomy, physics, sociology, and other sciences, than any teacher I have ever had, even in college!

It is now some months after you wrote that editorial. In hindsight, do you agree with me? Is the backlash as bad as you were afraid of?

DAVID E. RUBIN

15 Leverett Court
Staten Island, NY 10308

It's too early to say. Please note, though, I wasn't particularly concerned about NASA, but about the space program. One is a particular and temporary organization of fallible human beings, the other is a major historical trend.

Dear Stan;

In all the discussions (including your Sept. '86 editorial) concerning the potential effects of the Challenger disaster on the future of spaceflight (particularly manned spaceflight) there is one exceedingly important fact that seems to be continually overlooked. This fact is a rather uncomfortable one, which may explain the way it is constantly ignored, but it is a fact that is simultaneously a source of both hope and dismay for those of us who wish to see spaceflight ultimately become a routine phenomenon, and a trip to the moon as painless as a trip from New York to California.

As a bald statement, the fact itself can be very simply stated: WE ARE NOT ALONE. All discussions of the future of spaceflight seem to be based on the (incorrect) underlying assumptions that only the U.S. has the wherewithal to continue development of space, and that the potential for benefitting from space exploration belongs to us alone.

It doesn't take much deep thinking to see the error of this line of thought. Several nations have space capability, and at least one of them has a capability that not only matches, but exceeds our own. Our chief competitor in space, Russia, has demonstrated launch capabilities for heavier payloads, has had several times more cosmonaut-hours in space than we have, has had dry-land landing capability from the first, etc. Sometimes these accomplishments are pooh-poohed by people who say that, for example, we have better and lighter instrumentation and therefore don't need such heavy rockets. To this I respond:

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rockets without instruments may not learn as much, but instruments without rockets will learn nothing at all.

It is very instructive, especially for those of us who are too young to remember the pre-spaceflight era, to recall the real origin of spaceflight. Back in the early and middle 1950s the U.S. was, along with everybody else, in the final stages of recovery from WW II. Business was booming, hearts were light (despite a minor "police action" in "Asia, somewhere") and all was right with the world. America was considering whether it was possible, and if so, desirable, to return to our previous isolationist policies. To the average American of that time, the whole idea of spaceflight, rockets, trips to the moon, etc., was considered much too "science-fiction-ey," much too fantastic, much too out-of-the-world to be given any serious thought or consideration. This was exacerbated by political infighting between the army and air force for control of the fledgling space program.

Lo and behold, one fine morning we all woke up to find a RUSSIAN satellite orbiting the earth, without so much as a by-your-leave to us. As WW II had shown once before, we Americans are great at reacting to panic situations of that sort and panic we did. The result of that panic was that, in the short span of ten years, we did the impossible and put a man on the moon.

What was the aftermath of that accomplishment? Well, anyone who was a scientist or engineer at that time will remember that Congress, in its infinite wisdom, imposed such severe cutbacks severe economic depression long before the big "stagflation" recession of the early 1970s.

The (psychologically) depressing fact is that we, as a nation, have never had, and do not now have, a long term national commitment to space. Aside from our panic reaction at having failed to be first, we have no deep desire (as a nation) to be there. To respond to those who point to NASA's current activities, I would like to point to another large-scale project from about the same (pre-space) era.

How many of us still remember the Mohole? The year 1957 was designated worldwide as "The International Geophysical Year," a year in which international cooperation would be used to investigate many of the then-current problems of the earth's geology, physics, tectonics, etc.—a noble effort. Indeed, many such problems were attacked and solved.

One U.S. project was to drill a well that would be deep enough to penetrate the earth's crust and reach the mantle, at the Mohorovicic discontinuity—hence the name "Mohole." Progress on this project continued long enough to allow deep-well drilling techniques to be perfected—then the project was abandoned. The drilling techniques developed were used for the only other application they were suitable for: commercial drilling for oil. Once we found out how to make money from it, we lost interest in the original project and let it die.

I fear the same fate for the space program. Now that we have learned how to make money from orbiting space devices, we have no interest in extending our space capability beyond that (except for a few of us "cranks").

Thus my statement above: there is on the space program that the scientific and engineering professions suffered a cause for great hope that we, as HUMANS, will expand into space; but, given current attitudes, there is little hope that we, as AMERICANS will.

DR. HOWARD MARK

Suffern, NY

Dear Dr. Schimdt:

I just read your editorial entitled

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"After the Shock," and frankly, *I* am in shock. I have no argument with continuing the space program per se, although some damn good points can be made against the space program as to spending priorities. My shock, and even anger, are produced by the fact that nowhere in your editorial do you mention that the tragedy was preventable; that there are a few bureaucratic fools at both NASA and Thiokol, Inc., who should get the proverbial ax, as opposed to being kicked "upstairs." I find it astounding that these insensitive dunderheads have not been indicted for murder. Lest you consider my comment extreme, I would ask you what punishment should be meted out to specific individuals who possessed data which indicated that, given the ring weakness at certain temperatures, such a possibility of tragedy was greatly increased as to the odds. Knowing that, and further overriding the concern and even alarm of individual Thiokol engineers, constitutes negligence from my point of view and the guilty parties should bear the full brunt of their irresponsible acts and decisions.

I further understand through recent readings that NASA has jury-rigged the odds of a terrible accident from the get-go, that studies have shown a much lower set of odds than those projected by NASA, and that NASA used insubstantial data and nebulous assertions to greatly raise those same odds. An honest space program is one thing; playing with other people's lives is quite another. The deaths of Christa McAuliffe and the other astronauts *were* wasted and the "emotional aftertaste" is sour . . . and *not* because they died as an honorable sacrifice in a "big new venture," but because those who should know better decided that a *heightened* risk of death was acceptable, as long as nothing happened and no one found out about it. *That* is what is sad.

This letter would be much smaller in print, so I hope that hand-written lengthiness will not be used as an excuse not to print it; somehow, after "After the Shock," I have the distinct impression that you do not want readers to get the above data—prove me wrong!

DON BARSHAY

Malvern, PA

Look again at when the editorial was written: at that time I had no way of knowing that "the tragedy was preventable." (And was it, really? Monday morning quarterbacks always could have done the job, of course; now if only they could learn to get there at the right time, with sufficiently persuasive arguments. . . .) However, finding that there were "a few bureaucratic fools" at a couple of large organizations is hardly surprising; the real surprise would be to find a large organization that didn't have any. Every project in history has had to live with that kind of problem; the important ones get done anyway.

Sorry I couldn't fit in the second half of your letter, which dealt with controversies over uses of plutonium. That's another big issue in itself, only tenuously connected to this one, and your letter consisted mostly of out-of-context quotations which raise more questions than they answer.

I don't think that's a good way to start such a discussion—but the idea that I "don't want the readers to get certain data" is blatant nonsense. If we're going to raise a topic at all, I want them to get all the data they can; and that requires more than half a letter.

Incidentally, a note to all potential Brass Tacks contributors: please type your letters if at all possible. If they arrive untyped, somebody here has to type them before they go to the printer. The longer they are, the harder we have to think about whether we can afford to do that.

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Dear Mr. Schmidt:

In your October issue you included a "factual" article, or scientific opinion, by George W. Harper. I would like to point out that while there is some validity to Mr. Harper's points, he is neglecting the other side of the environmentalist argument—namely, that pollution does not cause just the greenhouse effect, but that it is bad in itself.

Mr. Harper opens his argument by bringing all the abuses of the word "pollution" to the reader's attention and insinuating that all anti-pollution measures are mistaken or poorly motivated. While there have been actual abuses, that does not change the fact that many forms of pollution are out-and-out *bad*. For example, lead pushed into the air by burning leaded gasoline has been shown to be detrimental to human health. In a recent study, it was shown that lead in very small amounts during development can lead to severe losses of I.Q. points. Leaded gasoline, incidentally, was one of the victims of the government's half-hearted war against pollution.

True, having particles in the air is beneficial in many ways. But there are many cases where the particles are much more dangerous than their absence. And, with all the energy being produced—and wasted—by millions of hair dryers, cars, lights, etc., as well as the buildup of CO_2 (Mr. Harper believes it cannot do us harm but neglects to mention that it could counter-act the loss of pollution), I do not believe we are in immediate danger of an ice age. Even if we were, surely more beneficial solutions could be found.

DAVID A. KATZ

Highland Park, NJ

I don't believe Mr. Harper "insinuates that all anti-pollution measures are mistaken or poorly motivated"—rather he's attacking a common tendency to assume that All Pollution Is Bad without looking at all *the effects involved. As JWC liked to say, "You can't do one thing," and in evaluating anything you have to look at* all *its consequences, including so-called "side effects," and not just the ones that happen to interest you.* ■

(continued from page 115)

out at Maloof's Tavern and swapping war stories.

Physically, the game is top-notch, with two urban terrain game boards, and four nicely detailed counter sheets of buildings, vehicles, warriors, and Mechs, which come with plastic stands.

And the game is hot. At last summer's national game conventions (*Origins* at Los Angeles and *Gen-Con* in Milwaukee) Battletech was everywhere, with people sprawled out on the hotel floors, many of them playing with carefully painted plastic and metal Mechs.

FASA is not resting on its laurels. The first BattleTech novels have appeared, full-length books set in the world of the Succession Wars. There's also a graphic novel (i.e. comic book) available, and the *BattleTech: Technical Readout*. This is a thick trade-paperback illustrating dozens of BattleMechs, Aerospace Fighters, tanks, hovercraft, and other gear of the BattleTech world.

FASA deserves a lot of credit for their accomplishment. In this day when many games depend on some kind of movie or book license to sell (like *Star Trek* or *Ghostbusters*), FASA has created its very own hot property.

And with all this activity, one can only wonder whether the BattleTech movie can be far behind. ■

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a calendar of analog upcoming events

2-5 April
AGGIECON 18 (Texas area SF conference) at Memorial Student Center, Texas A&M University. Guest of Honor—Ben Bova, Artist Guest of Honor—Rowena Morrill. Registration—$10 until 1 March, $13 thereafter. Info: AggieCon 18, Box J-1, Memborial Student Center, College Station TX 77844. (409) 845-1515.

3-5 April
GENERICON III (RPI SF conference) at Rensselaer Polytechnic Institute, Troy, N.Y. Guest of Honor—Joan D. Vinge. Artist Guest of Honor—Dawn Wilson. Registration—$12 until 20 March, $14 thereafter. Info: Genericon III, Box 66, Rensselaer Union, Troy NY 12181.

17-19 April
BALTICON 21 (Baltimore area SF conference) at Baltimore, Md. Guest of Honor—Roger Zelazny, Artist Guest of Honor—Michael Whelan, Special Guest of Honor—Tom Doherty, Fan Guest of Honor—Eva Whitley. Info: Balticon 21, Box 686, Baltimore MD 21203.

17-19 April
MINICON 22 (Twin Cities SF conference) at the Radisson South Hotel, Bloomington, Minn. Guest of Honor—David Brin, Fan Guest of Honor—Fred Haskell, Musician Guest of Honor—Jerry Stearns, Artist Guest of Honor—Erin McKee, TM—Robert Bloch. Registration—$13 until 22 March 1987, $25 at the door. Info: Minicon, PO Box 8297, Lake Street Station, Minneapolis MN 55408.

17-19 April
FEN FAIRE (New Orleans SF/Fsy conference) at Sheraton-New Orleans Hotel & Towers, New Orleans, La. Guest of Honor—Anne McCaffrey, Artist Guest of Honor—Frank Kelly Freas. Registration—$20 until 1 March 1987, $25 at the door. Info: FEN FAIRE, PO Box 740187, New Orleans LA 70174.

20-23 April
General meeting of the American Physical Society at Crystal City, Va. Info: A.P.S., 335 East 45th Street, New York, NY 10017.

24-26 April
MARCON XXII (Columbus SF conference) at the Radisson Hotel, Columbus, Ohio. Guest of Honor—Michael Kube-McDowell, Fan Guest of Honor—Bill Roper, TM—Juanita Coulson. Registration—$18 until 31 March, $20 thereafter (children 6-11 half price). Info: Marcon, PO Box 14078, Columbus OH 43214-0078.

27 August-2 September 1987
CONSPIRACY '87 (45th World Science Fiction Convention) at Metropole Hotel & Conference Centre, Brighton, U.K. Guests of Honour—Alfred Bester, Doris Lessing, Arkady and Boris Strugatsky; Fan Guests of Honour—Joyce and Ken Slater; Artist Guest of Honour—Jim Burn; Special Fan Guest—David Langford; TM—Brian Aldiss. Registration—Attending (until 30 September 1986) £25, $40, $A50; Supporting £10, $15, $A20; This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: ConSpiracy '87, Box 43, Cambridge CB1 3JJ, England, U.K. OR Bill & Mary Burns, 23 Kensington Court, Hempstead NY 11550 OR Justin Ackroyd, GPO Box 2708X, Melbourne, Vic. 3001 Australia.

—Anthony Lewis

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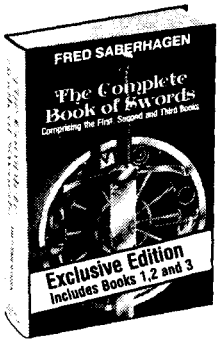
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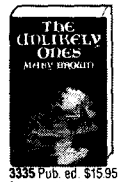

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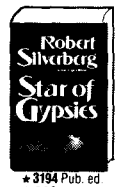

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